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ELECTRICAL WORLD

March 10, 1934

N.E.M.A. Prepares for Code Revision

In an all-industry meeting last week the electrical manufacturers tackled the job of making their NRA code fully workable

Service Reliability Measured by Probabilities of Outage

Does it cost more than it is worth to make a 270,000-kw. station so good that due to outages only 295 kw.-hr. of revenue output will be lost per year? A new approach to an old problem.

Select Capacitors to Meet Power-Factor Clauses

Not the installation which offers lowest first cost for optimum corrective effect but that with best ultimate economy urged

Manufacturer and User Analyze Cable Sheath Problem

Wherein lies the cause of present sheath failures, limited, it is true, to 20 per cent of cable?

The South Welcomes the T.V.A.

Government spending brings hopeful days to states where the industrial age has touched but lightly. Social planning the key.

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ELECTRICAL WORLD

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What in the World!

Big business is certainly on the spot these days. In one week come broadside assaults upon security markets, salaries and bonuses paid to top executives, interlocking directorates and the dead history of the new era loans by holding companies in the 1929 call money market. If Congress should openly split on the big business issue the anti-Wall Street repercussions might be tremendous.

●

Code problems or no code problems, it seems highly probable that a remarkably satisfactory volume of spring appliance business may develop. Electrical manufacturers are reported to have built up their stocks in anticipation of such an outcome and the public has more money with which to satisfy its latent willingness to buy. There is nothing left to clinch the matter but a first-class selling job. It should be well under way now.

●

Even though the newly emphasized problem of cable sheath failures in underground cable involves but a possible maximum of the total cable produced of but 20 per cent and represents relatively few individual failures it is a good problem to solve co-operatively—and soon. It is encouraging to see manufacturers and users discuss the matter in all its aspects so reasonably.

●

Southern appreciation of the T.V.A., as told in this issue, is in essence a story of simple souls responsive to unforeseen good fortune and caring little for the broader implications and ramifications of the bestowing of that bounty.

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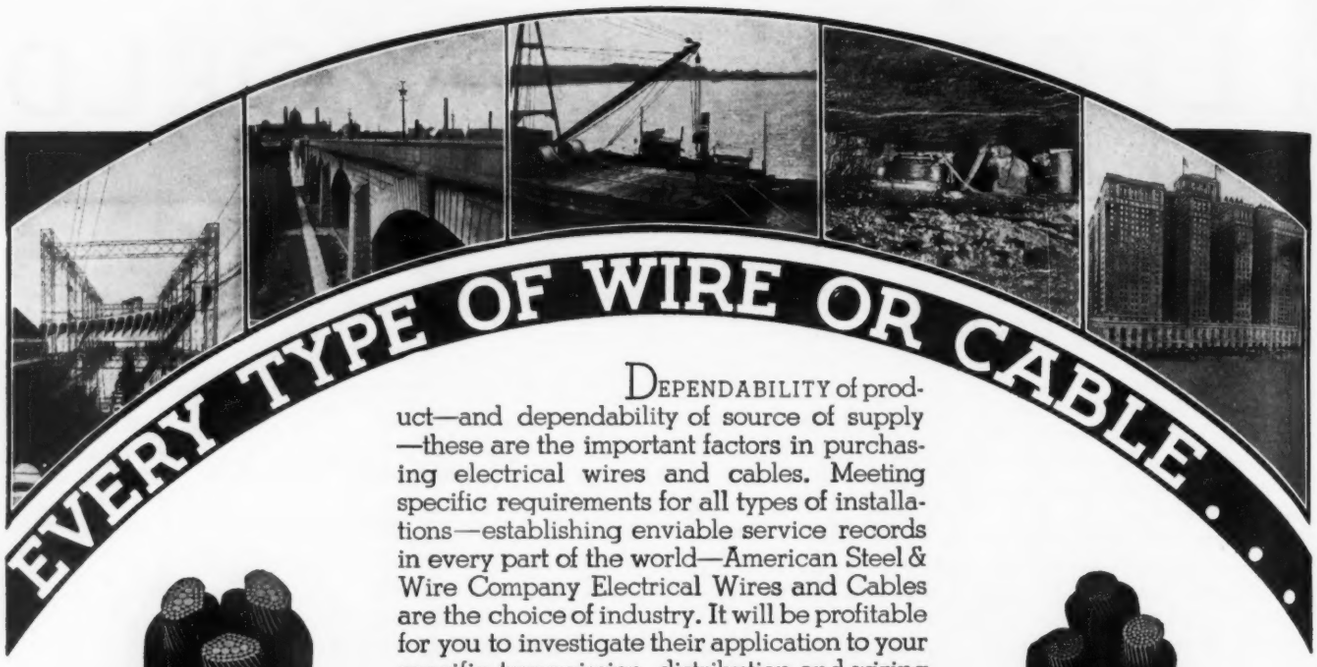

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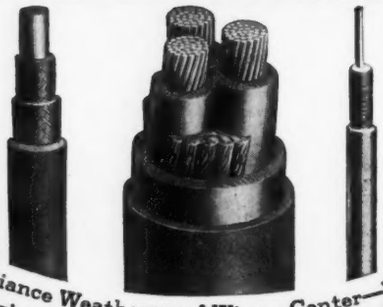
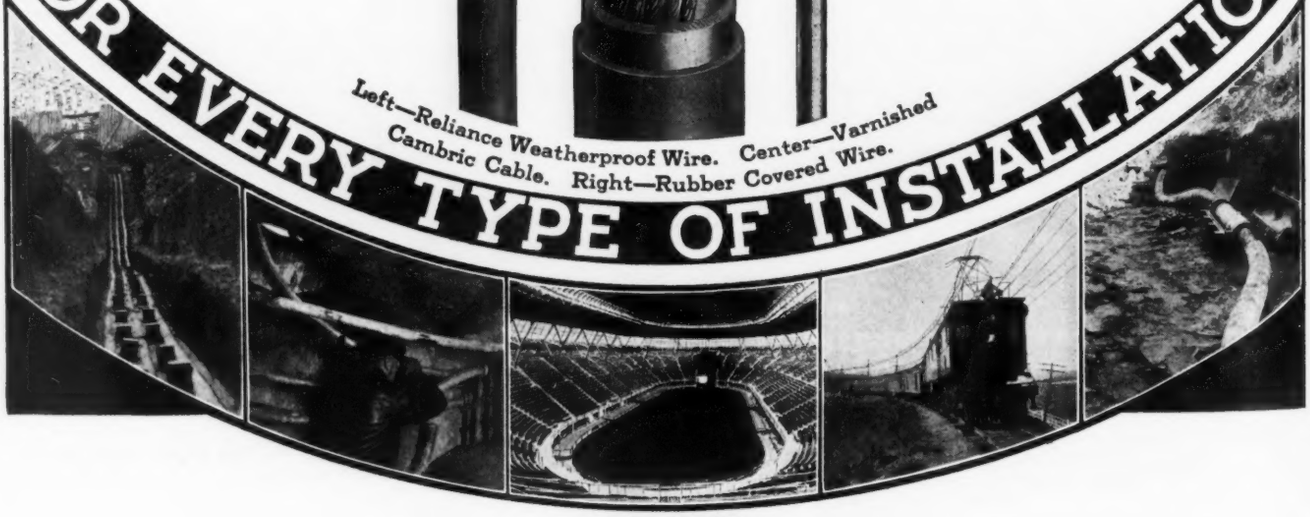


Left—Reliance Weatherproof Wire. Center—Varnished Cambric Cable. Right—Rubber Covered Wire.

FOR EVERY TYPE OF INSTALLATION



1831 — MORE THAN 100 YEARS of PROGRESS IN WIRE MAKING — 1934

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ELECTRICAL WORLD

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March 10, 1934

L. W. W. MORROW, *Editor*

Time to Meet Public Opinion With Action

AS PRESIDENT ROOSEVELT stated this week, an aroused public opinion is the most powerful force in this country. It is difficult to change and, if maintained, all but impossible to combat, even though it may not be right. At present there is definite evidence of an antagonistic public opinion about some aspects of the light and power business and this is increasing in volume. What can or should be done about it by the utilities? Public opinion also appears to call for a checking up of all industries to gear them to the new deal. This should be done without discarding essential verities. What can be done to get this rejuvenating stimulus into the utility business?

There is no failure of public favor for electrical products and services. There is no evidence that electrical markets will not expand or that light and power service has reached saturation. Why, then, is it not good business to face the criticisms made about the industry and do what is necessary to meet them or to change them if they are incorrect? This industry must go forward. And on the basis of a serious consideration of fundamental industry organizations and policies, perhaps changes can and should be made so that expansion will take place more quickly and in time with the new deal philosophy. For example, the holding company is abused and is in disrepute. It is granted no credit for the good work done or for its necessary functions as part of a co-ordinated industry. Then why not endeavor to abolish the name and the form?

It should be possible to do this and yet retain the essential values. It may even be to the advantage of the industry to do this for other reasons than to offset public criticism. Securities might be shifted to an investment trust and the officers of these trusts might be divorced from utility management responsibilities. Management functions of a joint character might be made available to operating executives through the use of the new corporations called "co-operatives," so favored by the government. Consulting management on a fee basis might be divorced from ownership and obtained through a management corporation. Perhaps, in this period, it would be desirable and advantageous to use to the utmost the initiative, talents and non-standardized efforts of local operating executives to bring about the reconstruction of the industry.

AN EQUALLY difficult but essential decision must be made with respect to industry personnel. If, as John E. Zimmermann has so well stated, utility management must become professional, why not place professional managers in charge? It is well known that the functions of managers have changed. The era of building, of expansion, of buying and selling properties, of internal organization development has passed. Now management must devote itself to sales, to routine operation, to building favorable public sentiment. Personnel should change with changed conditions. It is imperative that management as well as all employees do their work upon an entirely different basis today. Specifications, attitude and work are

different. It is necessary for utility executives to study the present internal and external conditions and opinions with open minds and with a constructive purpose. It is only reasonable to say that private utilities will survive on their own merits, and that they will not get anywhere by maintaining a defensive position or by appealing to public sympathy or investor interest. They can get somewhere, however, if they face the facts and act intelligently and courageously to improve their position. This is a time to remove restraints, to forget inhibitions and to use initiative, even though this involves a departure from standardization. We know that utility executives have the ability and the courage to meet successfully the challenge of a hostile public sentiment and of New Deal conditions of operation.

REWARDS

Revelations of the salaries and bonus payments received by business executives both in good times and bad force a serious consideration of the distribution of rewards in modern business. Undoubtedly political purpose was behind the collection of these data and their publication, but they deserve to be viewed objectively in the light of contemporary economic and social conditions. Can such rewards be merited when many shareholders receive no income, employee wages are low and unemployment large?

There is a growing opinion that the rewards to management have been too large during the last decade, at least relatively to the rewards received by stockholders, operators, engineers, clerks and common labor. There is also a belief that management has an unchecked and unsupervised control of large corporations because the multitude of stockholders cannot act effectively to voice its opinion on corporate affairs. In addition the trend has been toward professional management of business wherein the voice of the banks and not of the stockholders is heard loudest by management.

Political, social and economic checks may be anticipated upon the small group of men who manage each business corporation. That group will be restricted in fixing its own rewards as well as those for stockholders and employees. This involves a difficult problem and a dangerous doctrine. Merit in high places makes business enterprises successful and cannot be measured accurately or rewarded according to scale. But on the other hand, the selfish abuse of management privileges is not in the public interest nor in that of the business enterprise controlled. Between these two extremes a practical plan must be worked out and applied. That is the lesson of the valid evidence presented by the Federal Trade Commission.

N.E.M.A.

Like the summer thunder shower that clears the atmosphere with much noise and alarming flashes the N.E.M.A.-sponsored all-electrical manufacturing-industry meeting last week brought an ultimate satisfaction.

It brought the small manufacturer, whether N.E.M.A. member or not, the opportunity to have his say, without reservations, before his industry. It led to definite vote upon the revisions prepared for the purpose of making the electrical industry's NRA code workable. Of course the keynote of the meeting was to a large degree legal and defensive. Men bartering away their age-old rights under New Deal legislation must know to what degree they have committed themselves. One does not hazard his all without due precautions.

Over and above the detail discussion and voicing of conservative doubts there stands, however, the definite impression that just as the electrical manufacturing code was among the first to be prepared in a warm spirit of co-operation with NRA, and among the first to be signed by the President, so will its revision be given earnest support. Electrical manufacturers feel that they will benefit from their NRA code. This was clearly reflected in the corridors during the general meeting, when nearly a thousand industry men reviewed and revised the pact.

PRICES

Under the NRA code electrical manufacturers have found the opportunity to act in unison in the interest of public policy without being handicapped by the chiseling type of competition. In the past costs of distribution were high and competitive practices poorly thought out largely because of the dickering on prices for each order obtained. That situation made impossible a study of distribution, as it involves possible changes of practices, reductions in cost and the maintenance of fair competition. To eliminate the dickering, and that more attention might be devoted to sales and sales promotion, an open price policy was adopted.

What is now sought is the opportunity to establish in principle the right of various manufac-

turers to offer different but fair prices for a given product to be sold to a given class of trade in a given volume of purchase. Competition in the newer method of selling would thus involve normal but fixed price differentials, quality elements and service advantages, but without chiseling and without below-cost selling. If this idea can be made to work, and if there is no abuse or collusion, stabilization can undoubtedly be had with definite advantages.

Customers do not object to a fair price and a fair profit. They will object to a uniform price and any evidence of collusion in fixing prices. Many problems will be encountered by manufacturers in putting such an open price policy into practice. It will work only if there is an unselfish desire to carry out the spirit of the code as well as patience in developing both the knowledge and the mechanism to make the principle an every-day business practice.

This will be done, for the N.E.M.A. code points the only way to a fair and reasonable answer to fair and stable competition in the electrical manufacturing industry.

CODES

One of the greatest problems of all industry today is how to capitalize upon the NRA codes and make them constructive. Those industries which have been most successful so far in this direction have been those which have seized upon them as a new instrument for achieving a better status with the government, a closer relationship with labor and a more effective co-ordination with the industry itself. Those industries have sold themselves and their program to NRA and to labor by a frank acceptance of the dominant realities of the public interest involved and through their eagerness to make the most of that opportunity.

They have applied their ingenuity and enterprise to the building up of enthusiasm among their members for the probable advantages offered by the codes as well as to the winning of Washington confidence for their sincerity and zeal. Perhaps some of this spirit might well have been premeditatedly introduced at the N.E.M.A.-sponsored meeting, though the meeting was essentially one for considering and ratifying the intricate details of labor clauses and trade practice rules.

Electrical men have never had a better opportunity to organize for the promotion of their common interests than the codes now provide. Manufacturers, wholesalers, contractors and utility men face new measures of unaccustomed control; whether it will be government control or self-control will depend upon who brings the initiative and the leadership. The value of each code is largely what its industry makes it. In the end salesmanship will play a large part, both in sustaining co-operation and in creating broader markets.

RESEARCH

Beginning with the mass and the charge of the electron, gradual development of indirect experimental methods has presented a rapidly expanding picture of the proton, the neutron, the positron, the photon, the cosmic ray, the quantum, the double hydrogen atom, each with an attendant picture, both qualitative and quantitative, of respective peculiarities. The nearest approach to a discrete separation of the electron is probably the Milliken oil-drop experiment. Closely related are the ionization condensation paths of fast-moving charges of the Wilson expansion chamber and its followers, with their photographic reproductions. Another class of phenomena amazing in their interest are those in which, by the use of vacuum tube amplifiers, the separate effects of the arrival of the minute charge of a moving electron at an electrode may be detected. If the number of electrons in a stream is sufficiently small, these separate arrivals may be noted by appropriate methods.

In a recent paper presented to the annual meeting of the committee on electrical insulation, National Research Council, and now published in *Physics,* Messrs. Haworth and Bozorth have shown that in an insulator under stress approaching that of breakdown a succession of ionic avalanches occurs which may be studied by methods developed for the "shot effect." It is shown that these ionization avalanches occur in increasing numbers with increasing stress, and a highly suggestive picture is presented of the conditions preceding and leading up to breakdown. They begin well below the final breakdown stress, increasing therewith in approximately logarithmic relationship. The experiments were performed on glass and on mica, but there appears no reason why the method may not be extended to other materials. The wide range of stress over which these incipient breakdown paths may be discovered renders the method exceedingly promising for the study, not only of the nature of the obscure phenomenon of breakdown, but also of the relative stability and probable life of commercial insulating materials.

Manufacturer and User Analyze Cable

Sheath breaks, says the manufacturer, are not due to seams and charging welds. [1]

Troubles, says the user, come from but 20 per cent of the cable sheath. [2]

That other 80 per cent affords adequate strength against reasonable pulling tensions, overloads, internal pressures and duct slopes.

THERE has been more or less of an epidemic of cable sheath failures. Tracing these difficulties back to fabricating and operating techniques was thus a timely subject assigned for discussion at a meeting of the A.I.E.E. New York Section Power Group at Newark, N. J., late in February. The discussion at this meeting was reported in the news section of the February 24 issue of ELECTRICAL WORLD. Excerpts from the two papers as presented here detail the process of applying the extruded tube to the cable and also some of the techniques in installation and operation of cables in so far as they may possibly contribute to subsequent failures. Between the two efforts to allocate the causes one gets a clarifying picture of the probable trend in control and avoidance of these defects.

Mr. Peterson emphasizes the importance of looking at sheath failures as a matter of probability very definitely flavored by factors that tend to shift the location of the "operating requirement" line so as to encroach more or less (Fig. 1) on the quality performance built into the cable by the manufacturer. The rest of his paper is designed to dispel the notion that seams in the sheath are the seat of cable difficulties.

Mr. McCorkle gives valuable operating experience with heavy pulling tensions, pulling greases, long lengths, bend radii, bonding, oil pressures, overloads, alloyed lead, etc. He concludes that if all the cable were as good as 80 per cent now is the troubles with sheaths would vanish.

Sheath Failures Not Due to Mold and Charging Seams [1]

By THOMAS F. PETERSON
Consulting Cable Engineer,
American Steel & Wire Company, Worcester, Mass.

WELDS formed at the top and bottom of the lead sheath in the cable press extrusion process do not constitute a source of weakness. Thousands of tests on lengths of the lead "pipe" are proof of this. Relatively few sheath failures in the form of abrupt longitudinal splits confirm this. Pipes for test purposes have purposely been made thin across the top weld so as to increase the probability of failure at the weld. Hundreds of tests of this nature show perfect necking down of the shell, but no tendency for the break to occur at the weld. Tensile strength and elongation tests (Fig. 3) show that the welds are as strong as the rest of the wall and have similar elongation behavior.

Other designs of press than that represented in Fig. 2 are in use. Thus the bridgeless block of the Western Electric Company eliminates the upper radial weld. The Henley "straight through" press eliminates both welds, employing a ram which acts in the same direction as the axis of the cable.

Many uninformed engineers consider that the lead press "stop" for recharging indicates a weld between old and new charges. A careful analysis of the process in the press and of photomicrographs of extruded sections at frequent intervals along a one-charge length show that there is no localization of such an effect. It is distributed well along the length that is extruded between rechargings.

When the ram has reached a given point near the bottom of the cylinder (Fig. 2) it is withdrawn and a new charge of lead is poured. Oxides at the surface of the old lead, dross inclusions from the lead kettle, dirt, etc., are floated to the top and skimmed off. The charge is then cooled under a small pressure and finally extrusion is continued. The heat flow during the cooling period is radial. The temperature gradient through the lead is such as to make the central portion of the

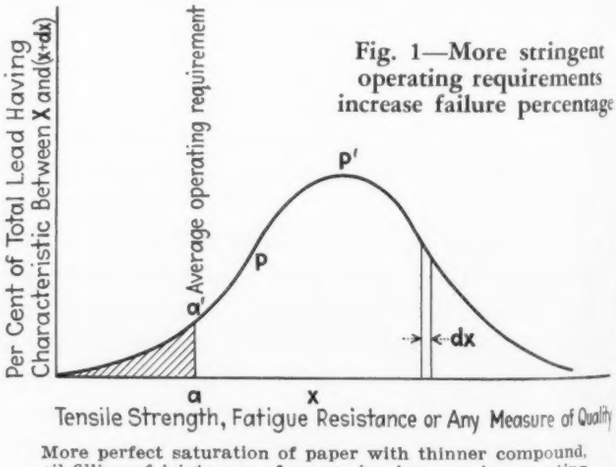


Fig. 1—More stringent operating requirements increase failure percentage

More perfect saturation of paper with thinner compound, oil filling of joints, use of reservoirs, increase in operating temperature range—all these took place from 1923 to 1930. They were accompanied by increased duty on the sheath; i.e., *aa'* was shifted to the right. Drained reservoirs called attention to the failures and allowed studies before destruction. Failures due to dross inclusion and split pipes fall to the left of *aa'* and are easily diagnosed. Swelling from excessive internal pressure falls to the right. Intermediate conditions may be complex. The manufacturer must know the limiting operating condition if he is to provide a "normal" lead of the right thickness and performance.

Sheath Problem

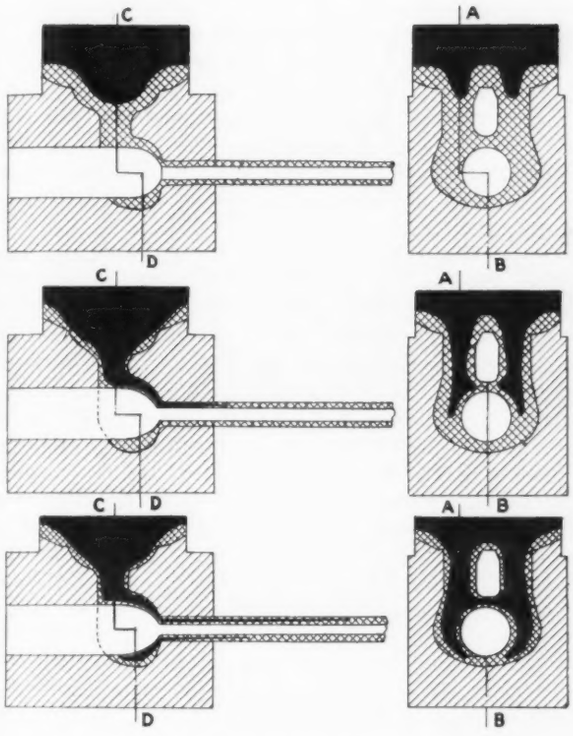


Fig. 2—Lead press welds seams at top and bottom of sheath

Molten lead at a temperature of 650 to 750 deg. is poured from a kettle into the cylinder, where it is allowed to cool under slight pressure. When the lead reaches a temperature of 325 to 400 deg. F. extrusion is started, the ram being forced down by a huge hydraulic piston. The stream of lead divides at the bridge, then unites to flow out around the cable, forming radial welds running longitudinally of the cable.

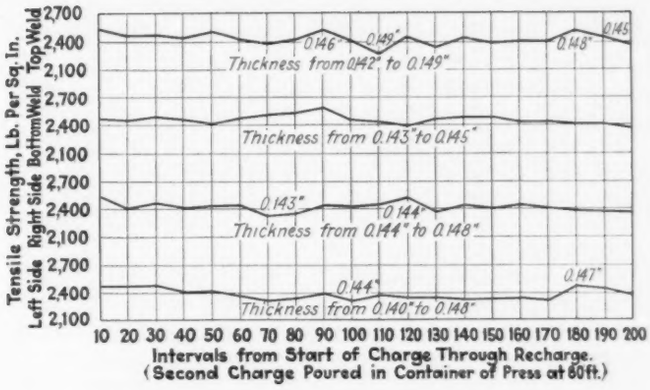


Fig. 3—Welds as strong as rest of sheath

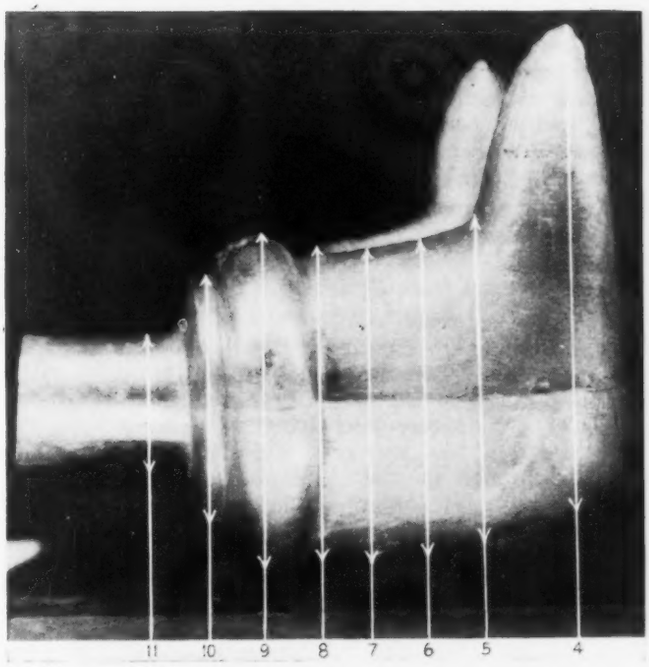


Fig. 4—Slug from press block analyzed for welds from successive charges

The sheath is beginning to form at section 11.

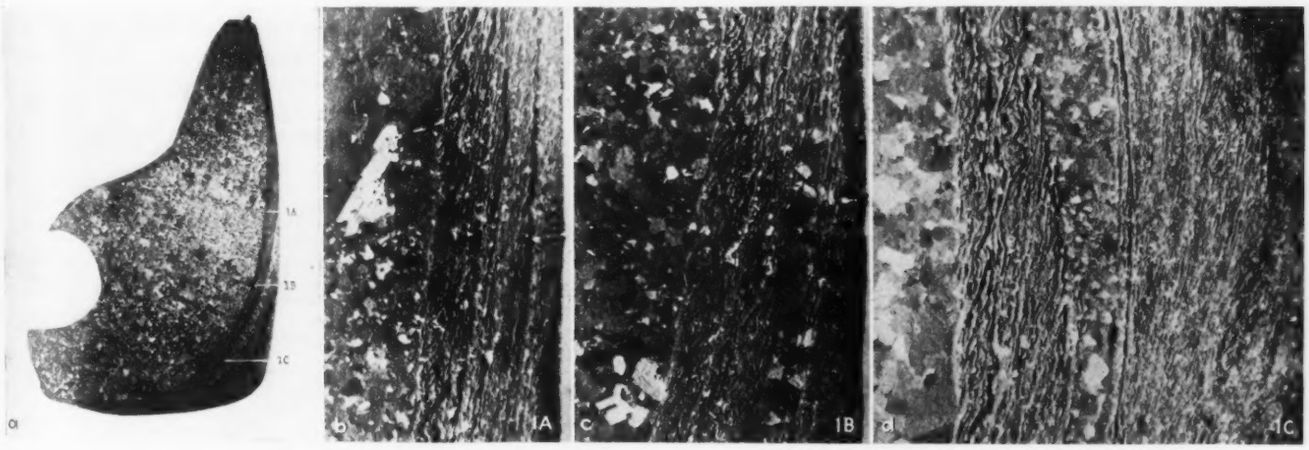


Fig. 5—Section of plug parallel to cable shows flow and vortex lines

(a) Macrograph of etched section; (b), (c), (d) photomicrographs show stream lines and vortices at welds of successive charges at points marked in (a).

charge have maximum temperature. As a result of this and of wall friction some of the new charge flows out on the cable long before the old charge is exhausted from the press. Depending on the amount of residual lead and on the size of the pipe, some 20 or 30 ft. of pipe will be produced by the old lead from the stop mark before new lead begins to appear in the form of crescents. These expand and ultimately embrace the entire circumference.

These crescents (sometimes called flow lines) represent section views of the elongated weld area that stretches out between charges. They are not indications of weakness. When the lead is annealed crystals grow across these lines, but their identity still persists. True, if the original boundary plane includes concentrations of oxides, dirt, etc., these may be sufficiently segregated in the sheath to leave gaps along the "flow lines." This action is, however, greatly minimized because the original weld area between charges is subject to extreme distortion and is ultimately stretched to 30 or 40 times its initial value. We may liken the action to that obtained when two unvulcanized sheets of rubber are put face to face with talc between and then stretched and pressed together. Another analogy might be that of making a bias braze or weld in a rod and subsequently drawing the rod down to a smaller size.

Cable lead under intensive study

Flow of lead from a Henley press is not unlike that described. The inner temperatures are a maximum. New lead finds its way out on the cable, appearing first at the inner surface and then expanding radially. The flow lines will have somewhat different characteristics, but they are approximately concentric.

Analysis of lead extrusion has also included studies of flow through the die blocks and cylinders. Figs. 4 and 5 show the contour of the weld between old and new charges and similar sections at 10-ft. intervals along the pipe show the spread of these welds over a considerable length of the sheath.

Cable manufacturers are engaged in work destined to improve the quality of all sheath lead; i.e., to move the peak of the probability curve in Fig. 1 more toward the right. Some of this comes under the heading of factory control and inspection. Some involves the introduction of new methods and devices. Cable manufacturers, lead press producers and university laboratories are engaged in studies to determine the characteristics of normal sheath and what tests will prove normalcy. The concerted work of all manufacturers is being correlated through the I.P.C.E.A. lead committee under the chairmanship of I. T. Faucett. This body is also responsible for co-ordination of the activities of the manufacturers with those of the A.E.I.C. The first technical report of the lead committee was presented to the high-tension cable committee of the A.E.I.C. last October and it is commended to cable operators for study.

Four-fifths of Cable Meets Operating Requirements [2]

By DANIEL S. McCORKLE
Assistant Engineer
New York & Queens Electric Light & Power Company, Flushing, N. Y.

ACCORDING to underground system committee reports (N.E.L.A. and E.E.I.) the percentage of cable failures attributed to sheath failure rose from 27.5 per cent in 1930 to 39.4 per cent in 1932 with a total of 218 sheath failures reported in 1932. Of these 46 were recorded as having initially defective sheath, there were 97 charged to electrolysis and 24 to wear at the duct mouth.

Only one sheath failure in 1932 was charged to excessive tension. It is difficult to specify definitely the maximum safe pulling tension on a lead-sheathed cable for all conditions because of the various factors involved. The stress should not be such as to cause permanent elongation, severe scoring, gouging or deformation of the sheath. An idea of what cable sheath will withstand and yet operate satisfactorily, except for pressure and corrosion effect, can be obtained from the accompanying table. There have been installations in which cable has been subjected to higher tensions. For installation conditions similar to those of the first three examples of Table I a maximum tension of 9.0 lb. per duct-foot is not considered dangerous for section lengths of 1,000 ft. Experience has proved that we may pull cable into straight or slightly curved well-lubricated duct sections of 1,000 to 1,200 ft. without serious injury to the lead sheath. Much cable has been installed without injury in ducts where the clearance was approximately 0.4 in.

Another sheath problem that must be solved at the time of installation is that of bonding in such manner as to minimize galvanic action between the bond wire and the sheath as well as to mitigate electrolysis along the cable. In the practice of the N. Y. & Q. E. L. & P. Co. (Fig. 6) care is taken to bring the wire approximately radially away from the lead sheath at both sides of the soldered connection, leaving no short air gap between the bond wire and sheath. The bond wire is bonded to no sheath at more than one point in the same manhole. Where special drainage connections are needed heavy bonding cables are used. Where metal cable supports are in contact with cable sheaths the stanchions are bonded. Bonding of all lead-sheathed cables is done in all manholes.

Table I—Sheaths Not Injured by Pulling Tensions Up to 9.6 Lb. per Duct-Foot

Length of Section, Ft.	Duct		Cable					Duct Clearance, In.	Max. Tension Lb. per Duct-Ft.	Coefficient of Friction†	Kind of Lubricant
	Kind	Size, In.	No. Pulled*	Wt., Lb./Ft.	O.D. Mils	Sheath Thickness, Mils Nom.	Min.				
601	Pump log	4	1	12.5	3,010	125	115	0.99	8.3	0.67	None
601	Pump log	4	1	12.5	3,010	125	115	0.99	4.2	0.34	Pulling grease
300	Fiber	4	1	12.5	3,010	125	117	0.99	5.0	0.40	Pulling grease
500	Conduform	5	3	5.2	1,660	125	...	‡1.42	9.6	0.61	Pulling grease
928	Fiber	4	3	3.3	1,335	125	...	‡1.12	3.3–4.9	0.33–0.5	Pulling grease

NOTE: All sections were practically straight. No injury to lead sheath in any installation.
*At one time. †Coefficient of friction between cable and duct.
‡For more than one cable, clearance is *I D* of duct minus diameter of circle inclosing cables.

Oil-filled cable and the adoption of oil-filled cable joints for solid paper-insulated cable greatly aided the detection of sheath failure before electrical failure took place. It is general practice to leave a reservoir with a gage pressure of from 5 to 15 lb. per square inch at the time of servicing. In general, it is considered good practice to allow the static internal pressure of solid paper-insulated cable having commercially pure lead sheath of standard thickness not to exceed 15 lb. per square inch. However, it is known that internal localized pressures far in excess of this value, perhaps 100 lb. per square inch or more, have developed for short lengths of time in solid paper-insulated cable during abrupt changes in load.

As a guide to equalized pressures developing in feeder cable, it is desirable to plot graphs of the change in elevation throughout the entire feeder length and correlate the elevation with the amount of static pressure observed. Such graphs may be found particularly useful during the first year of operation when the cable is taking up oil from the reservoirs.

Considerable pressure was found to have built up in solid paper-insulated cable with oil-filled joints in installations where the cable was installed on steep grades. The oil in seeking the lowest level migrated down-grade. When load came on the feeder high pressures developed due to the comparatively high temperature coefficient of the oil. The pressure stretched the sheath. As the temperature of the cable dropped more oil seeped down and the stretching process was repeated until failure took place. Such conditions have been remedied by frequent inspection, stop joints at shorter intervals and reservoirs with increased capacities.

Cable sheath is found corroded due to such agents as electrolysis, galvanic action, chemical action of alkalies, acetic acid, etc. Generally it is found that acid conditions having pH values ranging between 5 and 7 and alkali conditions ranging between 7 and 10 are prevalent in underground systems. Extreme conditions exist where much stronger solutions are encountered. In meeting the general case, little difference has been found in the corrosive resistance of commercially pure lead sheath and alloyed lead sheath. "Green" concrete ducts, exposing the lead sheath to lime, will cause sheath corrosion. Any treated wooden duct which may result in the formation of acetic acid will corrode lead sheath. Fortunately, creosoted yellow pine duct does not produce a corrosive action on lead sheath.

Arc-proofing materials sometimes corrode cable lead sheath. At present the writer's company uses an arc-

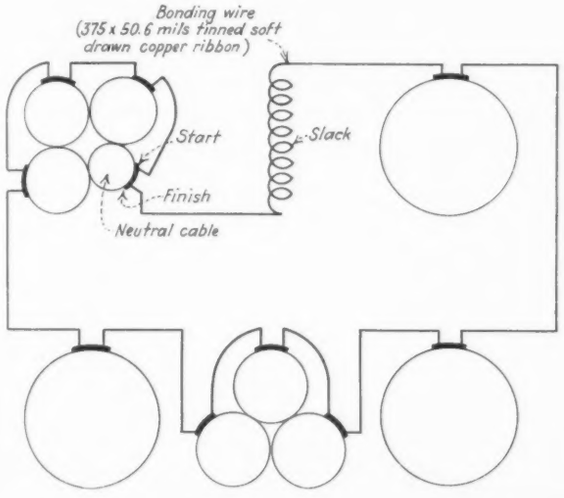


Fig. 6—All cables in manhole bonded in series

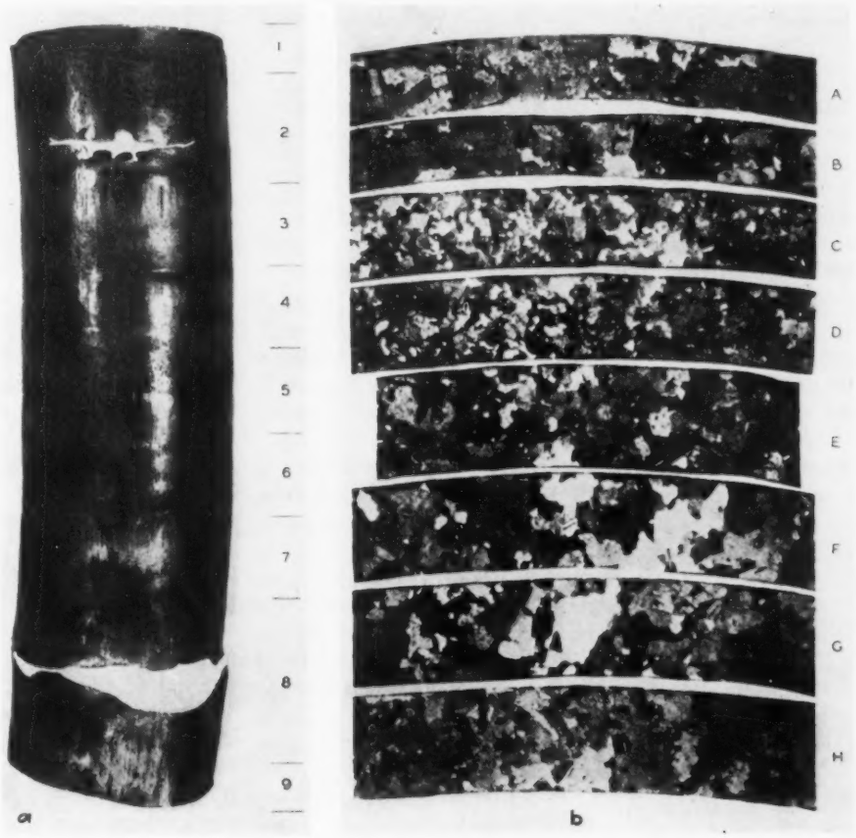


Fig. 7—Forty-five ruptures in 298-ft. length pulled at 2,700 lb.

(a) Characteristic form of break.

At section 1 the grain structure was small and uniform at the upper and lower welds. At either side of these welds there was an abrupt change in grain size.

(b) Grain structure variable in region of rupture (section 2).

(A) Upper weld—small grains at weld and abrupt change to larger grains near by. Minute grains at weld.

(B) Right of weld — large grains on either side of flow line.

(C) Left of weld — abrupt change of grain size.

(D) Left of C—continuation of mixed grain sizes.

(E) Left of D—grains becoming larger.

(F, G) Near lower weld — large grains.

(H) Lower weld — mixed grains attacked differently from sections above. Note minute grains and medium grain boundaries.

proofing material consisting of cement and sand mixed in a ratio of one part cement and two parts sand. An inner layer of non-hygroscopic tape is wrapped around the cable sheath first so as to prevent the alkali from coming in contact with the sheath. The cement used is a portland cement purchased in accordance with A.S.T.M. specifications C-9. Any cement which can liberate free lime is corrosive to lead, the lime dissolving the protective layer of lead oxide and allowing air oxidation.

During the past two years the N. Y. & Q. E. L. & P. Co. experienced lead sheath troubles due to manufacturing defects of which those shown in the table at right are typical.

There were approximately 45 ruptures of the sheath in the 298-ft. length of cable pulled in the case of failure No. 1. The nature of these ruptures and their location along the cable can be seen from Fig. 7. The thinnest part of the sheath and the upper weld are approximately along the center of the view shown. Bulges formed by the steel tape may also be seen.

The nominal sheath thickness was 125 mils. The minimum sheath thickness of the specimen examined was 67 mils, occurring in section 5. Photomicrographs of the grain structure indicate a heterogeneous crystalline structure which possibly may have been affected by mechanical handling of the cable. The information available does not include conclusive evidence that the changes of grain size noted are consistently indicative of mechanical weakness of lead sheath.

	Failure Found		Length of Section,	Pulling Tension,	Coefficient of	
No.	How	When	Ft.	Lb.	Friction	Nature of Defect
1	Observed at pulling end	When installed	280	2,700	0.725	Circumferential rupture
2	Observed	When unreeled				Sheath of adjacent turns fused together
3	Oil leak	After 3½ months operation	304			Break in sheath at lead press stop
4	Moisture in insulation	When splicing	670			Dross in lead

Here Is What Happens to the Consumer's Dollar

Bureau of the Census offers further results of recent national survey of electric light and power service

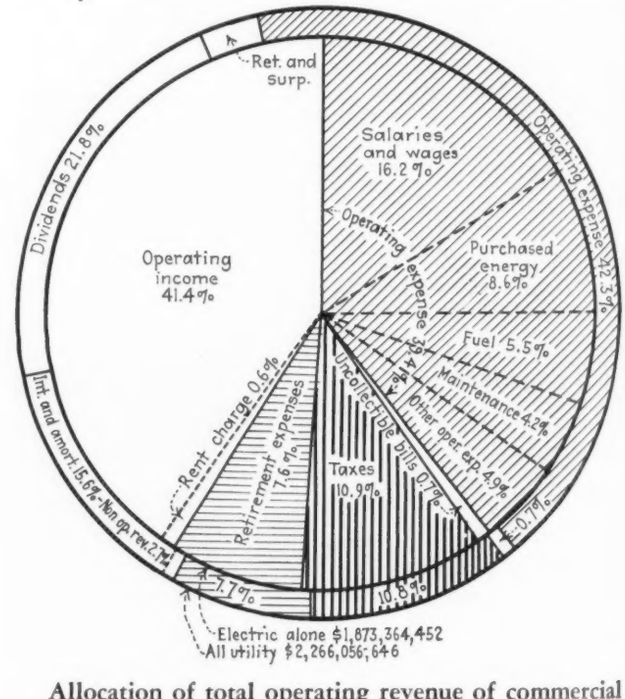
Revenue and expenses of electric light and power companies for 1932 were recently announced in the form of a consolidated statement by the Bureau of the Census (ELECTRICAL WORLD, January 13, 1934).

Commercial electric light and power companies received $1,703,303,728 of revenue from ultimate consumers; additional sums received for the sale of energy for resale brought the total to $1,854,109,509; to this total for the sale of utility service there was added a relatively small amount of miscellaneous revenue, bringing the total to $1,873,364,454. Corresponding figures for municipal establishments were $117,801,796, $121,194,446, $122,539,489.

In the accompanying table the various items of expense are compared with the total operating revenue. Thus operating expenses of commercial companies constituted 39.4 per cent of the total electric operating revenue, whereas the total operating expense for all utility service absorbed 42.3 per cent of the total operating revenue for such service. Taxes on electric service paid by commercial companies took 10.8 per cent of the corresponding total operating revenue, or 11.9 per cent of the revenue from ultimate consumers.

Ratio of Expenditures to Total Operating Revenue

	Commercial		Municipal	
	Electric Only	All Utility	Electric Only	All Utility
Operating expenses	39.4	42.3	54.2	54.5
Uncollectible bills	0.7	0.7	0.7	0.8
Taxes (including Federal income)	10.9	10.8	1.1	1.1
Retirement expenses	7.6	7.7	9.3	9.4
Total revenue deductions	58.6	61.5	65.3	65.7
Operating income	41.4	38.5	34.7	34.3
Rent charge to income	0.6	0.7		
Balance of income	40.8	37.8	34.7	34.3
Non-operating revenue	....	2.7	....	0.5
Interest and amortization of debt discount and expense	....	15.6	....	5.4
Other deductions	....	1.1	....	1.5
Net income	....	23.8	....	27.9
Retirement appropriated from surplus	1.2	1.1	1.2	1.3
Dividend on stock	....	21.8	....	....



Allocation of total operating revenue of commercial companies, census of 1932

Many companies and municipalities give other utility service in addition to light and power. Such composite plants are unable to segregate certain expenses between electric and other operations. These expenses are given in per cent of *total* operating revenue, including a small amount of miscellaneous revenue.

According to an earlier census release (ELECTRICAL WORLD, December 16, page 772) the total stock of commercial companies is $6,935,848,539. This includes composite companies. The dividends are equivalent to 7.1 per cent on that stock.

N.E.M.A. to Improve Its Code

THE N.E.M.A. basic code is to be amended to make it better to carry out the purposes of NRA and of the industry. Amendments, essentially as printed here, developed by N.E.M.A. board of governors were presented to 1,000 electrical manufacturers for discussion and change in New York March 1.

President J. S. Tritle opened the meeting and reminded the audience that the N.E.M.A. pact was the first code to be approved with open price clauses. He pointed out that nothing had been concealed in developing the code or in operating the code. Washington reports to the effect that small manufacturers were oppressed and that consumers complained that prices had been increased were, upon investigation, found to be in conflict with the facts. At the hearings the objections to the code were relatively insignificant or referred chiefly to patent and legal aspects of business not part of N.E.M.A. or to its code. Consumer complaints about increased prices were in the order of $40,000 in a business of several hundred million dollars. Mr. Tritle said: "N.E.M.A. has a record to be proud of so far as I am concerned and so far as the board of governors is concerned. We have a splendid record in code work, in holding down prices and in helping the government.

"The amendments presented today are before the whole industry, with every one having a full right of expression, and the board of governors is anxious to get this expression. There is nothing in these amendments that is detrimental to the small manufacturer or that has not received the unanimous approval of the board of governors. There are 650 company members and each has one vote. I make this statement because erroneous and unfounded statements have been circulated about N.E.M.A. and its work. I personally have never heard a selfish point of view expressed in developing this code. After the expressions to be made here are heard, then the board of governors and the code committee will go to work and present the final amendments in Washington."

More than 1,000 electrical manufacturers met in New York last week to discuss proposed amendments to the basic N.E.M.A. Code. The purpose of this meeting was to get the points of view of all electrical manufacturers on the contemplated changes. The amendments, with some deletions and changes authorized at the meeting, are printed in this article.

N.E.M.A. board of directors on the following day considered the suggestions made at the meeting and then authorized the code committee to present a slightly revised form of these amendments to NRA authorities. The amendments as printed do not necessarily represent the final form that will be submitted to NRA.

Major points of discussion

Essential points in the discussion are condensed in the following report of the meeting:

Article I—Changed to bring importers into the trade practices under the code. Active discussion was held on the clause permitting installation, servicing, etc., by the manufacturer. The point was made that for turbo-generator and other types of installations the manufacturer was forced to do installation work by trade practice and by guarantees of performance. It was not the intention to infringe upon the normal contracting business and was included as a protective clause. It was difficult if not impossible to make the clause more definite.

Article III—It was the consensus that no wage differentials between territories be stated in the basic code, but that the Code Administrator, upon application and investigation, might make such a differential. It was decided that each manufacturer was entitled to one apprentice and one office boy or learner and this amendment was accepted.

A long discussion was held on paragraph (e). In some instances employees had voted to work four nine-hour days a week. Other suggestions were that overtime be computed only upon excess hours in each week. The chair stated that apparently a day period was desired by NRA authorities and the desire of the NRA Labor Board was for a 35-hour week and a seven-hour day with overtime at 1½ normal. It was the sense of the meeting that the board should try to change this provision to specify a nine-hour day with no change in the weekly limits.

Article V—Some complaints have been made to NRA that the collection of N.E.M.A. statistics placed a burden on the small manufacturer. The Labor Board, however, says that insufficient statistics are afforded. F. C. Jones said all the statistics collected have been asked by NRA and it has approved all forms. A divided opinion was evident in the discussion as to the value of statistics and as to the burdens and costs involved.

Articles, VI, VII and VIII were approved with little discussion.

Articles IX and X—In presenting these key articles on trade practices C. L. Collens stated they were based upon (1) Open prices so that all competitors and all customers would know the prices; (2) each manufacturer would operate under term prices. Current net price schedules must be maintained. Sentiment about the value of net price and discount lists was favorable. Much discussion was had and several votes were taken on an amendment that would provide that the supervisory agency of a product group would be forced to get a favorable majority vote of the group before he issued a price call. Interpretation of Judge Neagle was that this was implied, at least, in the proposed amendments.

Prices come in for debate

Debate was had as to whether filed prices and discounts should be specific; that is, the definite price at which sales could be made for a definite period of time to a given class of trade. Opinion was divided as to the practical aspects of this principle, but a majority sentiment conceded its essential necessity as a stabilizing influence. It was explained clearly that prices and discounts were wholly optional to the individual manufacturer in his filing and that the ten-day interval gave opportunity for a definite procedure in changing term prices. Some statements were made that pressure had been brought to bear to line up manufacturers on uniform prices and the reply received to this was that it was not the official policy, was not authorized by the code and could not be done under code procedure.

Discussion was also held that if one branch filed prices and another did not, if these products were sold together, difficulty would arise. The reply was that "lump sum" bidding was not authorized under the code and that quotations should be made on each item.

Another topic for debate was the specification that would maintain resale prices. The penalty for violation was a cancellation of contract of the manufacturer only. All agreed to the resale price maintenance principle, but some pointed out the difficulty and cost of making contracts with every resale buyer. It was also stressed that the penalty of cancellation of contract affected the manufacturer only and that the resale agency might immediately sign up with a competing manufacturer. Another point was that the policing in the resale field should be done by the resale agencies. In reply it was stated that this provision was approved by the resale agencies and would be put in their codes and that the stabilizing element of the provision offset any disadvantages. The majority suggestion was an increased penalty for violation and that this should be placed on the resale agency.

Articles XI, XII, XIII and XIV—These articles were approved with little discussion except upon the contract provisions of Article XIV. Debate here was had as to procedure and the final form was adopted as printed in this issue.

Manufacturers co-operating

As the result of industry working under the code since last August the proposed amendments are considered necessary by N.E.M.A. The meeting was notable for the fair and open rulings of Mr. Tritle, the freedom of expression made by the small manufacturers and the almost unanimous agreement upon the amendments. Even discussion of monopoly control in industry, patent control and other matters was permitted, even though these belong in the category of law and not of code making. This was an open forum and the results should be very influential in getting NRA to accept the proposed amendments. Open hearings are expected in Washington in the near future.

Proposed Amendments to Code of Fair Competition for the Electrical Manufacturing Industry

Amend Article I so as to read as follows:

"I. The term 'Electrical Manufacturing Industry' or 'Industry' means promoting the manufacture, and/or the manufacture, for sale of electrical apparatus, appliances, material or supplies, and/or parts thereof and such other electrical or allied products as are natural affiliates; the erecting, installing, altering, repairing, servicing and maintaining by an employer, as hereinafter defined, of electrical apparatus, appliances and material of his own manufacture, and the maintenance by an employer, as hereinafter defined, of electrical apparatus, appliances, material or supplies in his own plant or plants. Any person, as hereinafter defined, who, as the agent or representative of a foreign manufacturer, imports from outside the continental United States for resale within the United States electrical products as herein defined shall, for all purposes of this code, be considered as one promoting the manufacture of such electrical products.

The term 'person' means natural persons, partnerships, associations, trusts, trustees, trustees in bankruptcy, corporations (including all wholly or partly owned subsidiaries and all parent companies) or other entities.

The term 'employer' means every person promoting, as herein defined, and/or actively engaged in, the manufacture for sale of the products of the electrical manufacturing industry as herein defined, provided, however, that organizations or groups of employers representing a substantial part of any branch or subdivision of the industry may have such branch or subdivision exempted by the Administrator from the provisions of this code.

The term 'employee' means anyone who is employed by any such employer.

The term 'learner' means an employee without previous experience in the class of work for which he is engaged, but who shall not be so classified after six-weeks' experience.

The term 'Act' means Title I of the National Industrial Recovery Act.

The term 'President' means the President of the United States.

The term 'Administrator' means the administrator of the Act.

The term 'effective date' means, in respect to this code, the eleventh day after the approval thereof by the President, and, in respect to any amendment or amendments thereof or additions thereto, the eleventh day after the approval by the President of such amendment or amendments or additions."

Amend Article III so as to read as follows:

"III. (*a*) On and after the effective date no employer shall employ anyone under the age of sixteen years, nor anyone under the age of eighteen years in any hazardous occupation; provided, however, that where a State law provides a higher minimum age no employer shall employ anyone below such minimum age within such state.

(*b*) On and after the effective date the minimum wage that shall be paid by any employer to any employee engaged in the processing of the products of the electrical manufacturing industry and in labor operations directly incident thereto shall be forty cents (40c.) per hour for male employees, and thirty-five cents (35c.) per hour for female employees, provided, however, that learners may be paid not less than eighty per cent (80%) of such minimum wage, but the total number of learners employed by any one employer at such reduced rate shall not exceed five per cent (5%) of the total number of employees of such employer covered by the provisions of this paragraph (*b*).

(*c*) On and after the effective date the minimum wage that shall be paid by any employer to all other employees, except commission salespeople, shall be at the rate of fifteen dollars ($15) per week; provided, however, that office boys or girls and learners may be paid at the rate of not less than eighty per cent (80%) of such minimum wage, but the total number of such office boys or girls and learners employed by any one employer at such reduced rate shall not exceed five per cent (5%) of the total number of employees of such employer covered by the provisions of this paragraph (*c*).

(*d*) Not later than November 15, 1933, each employer in the electrical manufacturing industry shall report to the Administrator through the Code Authority the action taken by such employer in adjusting the hourly wage rates for all employees receiving more than the minimum rates provided in paragraph (*b*) of this article.

(*e*) This article establishes a minimum rate of pay regardless of whether an employee is compensated on a time rate, piece work or other basis.

(*f*) A person whose earning capacity is limited because of physical or mental handicap may be employed on light work at a wage below the minimum established by this code, but the total number of such employees employed by any one employer shall not exceed five per cent (5%) of the total employees of such employer.

Amend Article IV so as to read as follows:

"IV. (*a*) On and after the effective date no employer shall employ any employee engaged in the processing of products of the electrical manufacturing industry and in labor operations directly incident thereto, in excess of an average of thirty-six (36) hours per week in any two week period or in excess of forty (40) hours during any week, nor any other employee (except executives, administrative, supervisory, professional and technical employees and their immediate assistants who are paid at the rate of thirty-five dollars ($35) or more per week, traveling sales and service employees and commission salespeople), in excess of forty (40) hours per week; provided, however, that these limitations shall not apply:

1. To conditions of seasonal or peak demand as determined by the proper supervisory agency, in which cases such number of hours may be worked as are required by the necessities of the situation, but not to exceed forty-four (44) hours per week for any twelve (12) weeks in any twelve (12) consecutive months.

2. To watchmen and firemen who may be employed not to exceed fifty-six (56) hours per week.

3. To employees while engaged in emergency work necessary to continued operation of plant or equipment of employer or customer, or to the safety or health of employees of employer or customer or the public.

4. To highlv skilled workers in very special cases where restriction of hours would unavoidably reduce or delay production.

(*b*) It is, however, expressly provided that on and after the effective date and so long as the hours of labor provided in approved codes for the metal working and capital goods industries employing workers of the same general class as the electrical manufacturing industry are forty (40) hours per week, no employer shall employ any employee, except executives, administrative, supervisory, professional and technical employees and their immediate assistants who are paid at the rate of thirty-five dollars ($35) or more per week, traveling sales and service employees and commission salespeople, in excess of forty (40) hours per week; provided, however, that these limitations shall not apply:

1. To conditions of seasonal or peak demand as determined by the proper supervisory agency, in which cases such number of hours may be worked as are required by the necessities of the situation, but not to exceed forty-eight (48) hours per week for any twelve (12) weeks in any twelve (12) consecutive months.

2. To watchmen or firemen who may be employed not to exceed fifty-six (56) hours per week.

3. To employees while engaged in emergency work necessary to continued operation of plant or equipment of employer or customer, or to the safety or health of employees of employer or customer or the public.

4. To highly skilled workers in very special cases where restriction of hours would unavoidably reduce or delay production.

This paragraph (*b*) shall continue in effect until ten days after such date as the Administrator shall inform the Code Authority that the hours of labor in approved codes of the metal working and capital goods industries have been coordinated with the hours provided in paragraph (*a*) of this Article.

(*c*) Where seasonal or peak demand places an unusual and temporary burden upon any branch or branches of the industry the approved supplemental code or codes for such branch or branches may make such provision for additional hours as is required by the necessities of the situation.

(*d*) At the end of such period as the Code Authority may prescribe each employer shall report to the code authority in such detail as may be required the number of man-hours worked in that month for emergency reasons under paragraphs (*a*) 3, (*a*) 4, (*b*) 3 and (*b*) 4 of this article.

(*e*) Where in any case any employee engaged in the processing of products of the electrical manufacturing industry, and in labor operations directly incident thereto, shall work in excess of eight (8) hours per day, time and a half shall be paid for the excess hours so worked."

Amend Article V so as to read as follows:

"V. (*a*) The Board of Governors of National Electrical Manufacturers Association, as from time to time constituted and not exceeding thirty members, together with not to exceed three members without vote to be appointed by the Administrator, are hereby constituted the Code Authority for administering, supervising and promoting the performance of the provisions of this code; provided, however, that if the Administrator deems it advisable that employers not members of National Electrical Manufacturers Association but who have agreed to bear their pro rata share of the cost of creating and administering this code be represented on the Code Authority, not more than eight additional members of the Code Authority may be selected by a method insuring equitable representation from among those employers not members of National Electrical Manufacturers Association who have agreed to pay their pro rata share of the reasonable cost of creating and administering this code as determined by the Code Authority.

(*b*) With a view to keeping the President and the Administrator informed as to the observance or non-observance of this code, and as to whether the electrical manufacturing industry is taking appropriate steps to effectuate in all respects the declared policy of the Act, each employer shall prepare and file with the Statistical Department of the Code Authority, and at such times and in such manner as may be prescribed, statistics of plant capacity, volume of production, volume of sales in units and dollars, orders received, unfilled orders, stocks on hand, inventory, both raw and finished, number of employees, wage rates, employee earnings, hours of work, and such other data or information as the Code Authority may from time to time require.

(*c*) Except as otherwise provided in the Act all statistics, data and information filed in accordance with the provisions of this article shall be confidential, and the statistics, data and information of one employer shall not be revealed without his consent to any other employer, except that for the purpose of facilitating the administration and enforcement of the provisions of this code the Code Authority may authorize access thereto by confidential representatives who shall not be in the employ of any employer affected by this code, and who shall not disclose the information obtained in such manner as to reveal the statistics, data and information of any individual employer. Nothing in this paragraph (*c*) contained, however, shall prevent the preparation and publication of summaries of such statistics, data and information.

(*d*) The Code Authority may appoint such committees, consisting of members, or non-members, or both, as it may deem advisable, and may delegate to such committees such authority as it may deem necessary or proper for promoting the administration and supervision of this code, and it may employ such paid personnel as it deems necessary for the proper execution of the functions assigned to it by this code; provided, however, that membership on committees to which powers are delegated shall be proportional, as nearly as may be practical, among members of the Code Authority who are members of the Board of Governors of National Electrical Manufacturers Association and members of the Code Authority not members of the N.E.M.A.

(*e*) Nothing contained in this code shall be deemed to constitute the members of the Code Authority or of any Supervisory Agency or employers in the industry partners for any purpose whatsoever. Nor shall any member of the Code Authority or of any Supervisory Agency be liable in any manner to anyone for any act of any other member, officer, agent or employee of the Code Authority or any Supervisory Agency. Nor shall any member of the Code Authority or of any Supervisory Agency exercising reasonable diligence in the performance of his functions under this code be liable to anyone for any act or omission to act under the provisions of this code except for his own willful misfeasance or non-feasance."

Amend Article VI so as to read as follows:

"VI. (*a*) Aggregations of employers having a common interest and common problems will be grouped by the Code Authority for administrative purposes in various subdivisions or product classifications, and report of such grouping made to the Administrator.

(*b*) In each subdivision or product classification there will be a Supervisory Agency approved or appointed by the Code Authority, and report thereof made to the Administrator. The Administrator shall have the right to appoint one member without vote to each Supervisory Agency. The Code Authority shall have the right to remove any Supervisory Agency or any member thereof and to approve or appoint any successor or successors.

(*c*) If complaint is made to the Administrator that the Supervisory Agency for any subdivision or product classification does not equitably represent the employers of such subdivision or product classification, the facts in connection with the selection of such Supervisory Agency shall be reported to the Administrator, and if there is reasonable ground for such complaint the Administrator may require the selection of a new Supervisory Agency for such subdivision or product classification by such method as in his judgment will insure equitable representation to all employers.

(*d*) If formal complaint is made to the Code Authority or to the proper Supervisory Agency that the provisions of this code have been violated by any employer, the proper Supervisory Agency shall investigate the facts and to that end may cause such examination or audit to be made as may be deemed necessary. If upon such investigation it be shown that the provisions of this code have been violated, the cost of such investigation shall be paid by the employer against whom the complaint has been made; provided, however, that if any employer complained against shall so request, such examination or audit shall

be made by an independent public accountant selected by the proper Supervisory Agency, the expense of such examination to be paid by the employer requesting it."

Amend Article VII so as to read as follows:

"VII. Any employer in the industry may share in the activities of the Code Authority or any Supervisory Agency under this code may participate in the selection of any Supervisory Agency or in the preparation of any revisions of, or additions or supplements to, this code. Every employer in the industry shall pay his proper pro rata share of the reasonable cost of creating and administering this code and any applicable supplemental codes as determined by the Code Authority, or may become a member of National Manufacturers Association, and upon payment of dues as such member shall be deemed to have paid his proper pro rata share of such cost."

Amend Article VIII so as to read as follows:

"VIII. Every employer shall use an accounting system which conforms to the principles of the uniform and standard method of accounting set forth in the sixth edition of the manual of accounting prepared and published by National Electrical Manufacturers Association, and a costing system which conforms to the principles of and gives substantially as accurate results as the standard and uniform method of costing formulated or approved by the Code Authority (subject to review by the Administrator, who may approve or disapprove), with such variations therefrom as may be required by the individual conditions affecting any employers or group of employers, and as may be approved by the Code Authority or the proper Supervisory Agency, and made supplements to the said manual of accounting or method of costing."

Amend Article IX so as to read as follows:

"IX. No employer shall sell or exchange any product of his manufacture at a price or upon terms or conditions which will result in the customer paying for the goods received less than the cost to the seller determined in accordance with the uniform and standard method of costing hereinabove prescribed, nor file any price pursuant to Article X hereof at less than such price; provided, however, that dropped lines, seconds, or inventories which must be converted into cash to meet emergency needs, may be disposed of in such manner and on such terms and conditions as the proper Supervisory Agency may approve and as are necessary to move such product into buyer's hands, and provided, further, that selling below cost in order to meet existing competition on products of equivalent design, character, quality or specification, shall not be deemed a violation of this article if provision therefor is made in supplemental codes for any subdivision or product classification of the industry which may be hereafter prepared and duly approved by the Administrator."

Amend Article X so as to read as follows:

"X. (*a*) If the Supervisory Agency therefor determines that in any branch or subdivision of the electrical manufacturing industry it has been the generally recognized practice to sell a specified product on the basis of net price lists, or price lists with discount sheets, and fixed terms of sale and payment, each person manufacturing, or promoting the manufacture of, such product for sale shall, within ten (10) days after notice of such determination, file with the Supervisory Agency a net price list or a price list and discount sheet, as the case may be, showing his current prices, or prices and discounts, and terms of sale and payment for the generally recognized classifications of customers for such product as determined by the Supervisory Agency, and the Supervisory Agency shall send copies thereof to all known persons manufacturing, or promoting the manufacture of, such specified product for sale.

(*b*) Revised price lists and/or discount sheets and/or terms of sale or payment may be filed from time to time thereafter with the Supervisory Agency by any person manufacturing, or promoting the manufacture of, such specified product for sale which shall become effective upon the date specified therein, but such revised price lists and/or discount sheets and/or terms of sale and payment shall be filed with the Supervisory Agency ten (10) days in advance of the effective date unless the Supervisory Agency shall authorize a shorter period. Copies of such revised price lists and/or discount sheets and/or terms of sale and payment with notice of the effective date specified shall be immediately sent to all known persons manufacturing, or promoting the manufacture of, such specified product for sale, any of whom may file, if he so desires, to become effective upon the date when the revised price list and/or discount sheet and/or terms of sale and payment first filed shall go into effect, revisions of his price lists and/or discount sheets and/or terms of sale and payment establishing prices, or prices and discounts, not lower or terms of sale or payment not better than those established in the revised price lists and/or discount sheets and/or terms of sale and payment first filed. The procedure and the conditions specified hereinabove for the revision of price lists and/or discount sheets and/or terms of sale and payment shall also apply to any initial filing made by any person subsequent to the effective date of any price call, as in cases where a person fails or refuses to file price lists and/or discount sheets and/or terms of sale and payment on or before the effective date of any price call, or where any person begins to manufacture or promote the manufacture of a product covered by a prior price call or for any other reason.

(*c*) If the Supervisory Agency therefor shall determine that in any branch or subdivision of the electrical manufacturing industry not now selling its products on the basis of price lists, with or without discount sheets, with fixed terms of sale and payment, the distribution or marketing conditions in said branch or subdivision are the same as or similar to the distribution or marketing conditions in a branch or subdivision of the industry where the use of price lists, with or without discount sheets, and fixed terms of sale and payment is well recognized and that a system of selling on net price lists, or price lists and discount sheets, with fixed terms of sale and payment should be put into effect in such branch or subdivision in respect to any specified product or products thereof, then each person manufacturing, or promoting the manufacture of, such product or products for sale shall, within twenty (20) days after notice of such determination, file with the Supervisory Agency net price lists or price lists and discount sheets, as the Supervisory Agency may direct, showing his current net prices, or prices and discounts, and terms of sale or payment for the general recognized classifications of customers of such product as determined by the Supervisory Agency, and such price lists and/or discount sheets and/or terms of payment may be thereafter revised in the manner hereinabove provided. Copies of all price lists and discount sheets and terms of sale and payment, whether originally filed in accordance with the provisions of this paragraph or thereafter revised shall be sent to all known persons manufacturing, or promoting the manufacture of, the specified product for sale.

(*d*) Any Supervisory Agency may, after giving notice of determination that any specified product shall be sold on the basis of net price lists and/or price lists with discount sheets and/or fixed terms of sale and payment, amend or modify in any respect such determination and give notice thereof.

(*e*) If any Supervisory Agency shall, with the approval of the Code Authority, determine that it is undesirable to continue the filing of net price lists and/or price lists with discount sheets and/or fixed terms of sale and payment on any product in respect of which such filing has theretofore been required, such filing shall cease and the provisions of this Article shall not apply to such product unless and until the Supervisory Agency with the approval of the Code Authority shall again determine that such filing be made.

(*f*) The proper Supervisory Agency shall have power on its own initiative or at the request of the Administrator or on the complaint of any employer to investigate any price for any product shown in any net price list or price list with discount sheet filed with such Supervisory Agency by any employer, and, for the purpose of the investigation thereof, to require such employer to furnish such information concerning the cost of manufacturing and selling such product as the Supervisory Agency shall deem necessary or proper for such purpose. If the Supervisory Agency after such investigation shall determine that such price is an unfair price for such product, having regard to the cost of manufacturing and selling such product, and that the maintenance of such unfair price may result in unfair competition in the industry or be against the interest of the purchasers thereof and be contrary to the spirit of the National Industrial Recovery Act, the Supervisory Agency, with the approval of the Code Authority, may require the employer who filed the list or discount sheet in which such unfair price is shown to file a new list or discount sheet showing a fair price for such product either lower or higher as may be specified, which fair price shall become effective immediately upon the filing of such list or discount sheet. If such employer shall not within ten (10) days after notice to it of such determination by the Supervisory Agency and approval by the Code Authority file a new list or discount sheet show-

ing such fair price for such product, the Supervisory Agency with the approval of the Code Authority and the Administrator shall have power to fix a fair price for such product, which fair price, however, shall not be lower if a decreased price was specified, or higher if an increased price was specified, than the price of any other employer at that time effective for such product, and in respect of which the Supervisory Agency shall not theretofore have begun an investigation or a complaint shall not have been made. When the decision of the Supervisory Agency fixing such fair price in the manner above provided shall have been filed with the Code Authority and it shall have given notice thereof to such employer, such fair price shall be the price for such employer for such product until it shall have been changed as in this code provided.

(*g*) Whenever, in any branch of the industry price lists have been filed, or called for, in the manner provided in this Article, or any specific product, the marketing and distribution channels used being wholesalers, dealers, or others who purchase and resell the said product of one employer in competition with the direct sales of said product of any other employer and the Supervisory Agency shall so determine, each employer manufacturing such product and selling to such wholesalers, dealers, or other resellers, either directly or indirectly, shall within thirty days after notice of such determination enter into a contract or agreement of sale requiring each such wholesaler, dealer, or other reseller to accept and be bound by the provisions of this Article and further requiring such wholesaler, dealer or other reseller to enter into similar contracts or agreements of sale with subsequent resellers in competition with the direct sales of such product of any other employer. Wholesalers, dealers and other resellers bound by such contracts or agreements of sale shall be eligible to participate in the provisions of Article X of this code without expense to them. The filing of his price lists by any reseller in the manner herein provided for employers shall not be required if the reseller files a written notice with the employer whose product he purchases and resells to the effect that, in lieu of individual filing of his lists, he has accepted and will maintain the prices, terms of payment and other conditions of sale from time to time established and filed by such employer with the Supervisory Agency. The employer shall thereupon immediately file a copy of such notice with the Supervisory Agency and shall keep each such reseller advised not later than the effective date of the filed prices, terms of payment and other conditions of sale to be maintained by the reseller, and of all subsequent revisions filed by said employer in accordance with the provisions of this Article. Violation of the provisions of this Article shall constitute proper ground for the immediate cancellation by any employer of any contract or agreement of sale with any wholesaler, dealer or other reseller, and when in the opinion of the Supervisory Agency after complaint and investigation, the facts found show such violation, the Supervisory Agency may order the cancellation of any such contract or agreement of sale.

(*h*) Each person affected by any of the provisions of this article shall furnish the Supervisory Agency such number of copies of his net price lists, or price lists and discount sheets, showing his terms of sale and payment as the Supervisory Agency may reasonably require for distribution and administration purposes. Copies of all effective price lists or price lists and discount sheets, showing terms of sale and payment, shall be available for inspection by interested parties.

(*i*) Unless otherwise provided in a supplemental code or codes applicable to one or more branches or subdivisions or product classifications of the electrical manufacturing industry, no person shall quote, bid, or sell, directly or indirectly by any means whatsoever, any product of the industry covered by the provisions of this Article at a price lower or at discounts greater or on more favorable terms of sale and payment than are set forth as current in his filed net price lists, or price lists and discount sheets, with fixed terms of sale and payment. The provisions of this Article shall apply to and affect quotations, bids and sales to the United States Government and to any and all instrumentalities whose purchases are made with funds provided or loaned by the United States Government or any of its political subdivisions.

(*j*) Nothing in this Article contained shall apply to products sold to employees not to be resold by them, or to products sold by one employer *to another employer manufacturing the same line of products* unless otherwise provided in a supplemental code applicable to one or more branches or subdivisions or product classifications of the electrical manufacturing industry."

Amend Article XI so as to read as follows:

"XI. The provisions of Articles VIII, IX and X shall not apply to direct export sales of any product or to sales of any product destined ultimately for export. The term 'export' shall include shipment to foreign countries and to the territories and possessions of the United States.

This Article shall be applicable to all employers in the electrical manufacturing industry unless otherwise provided in a supplemental code or codes applicable to one or more branches or subdivisions or product classifications of the electrical manufacturing industry."

Amend Article XII so as to read as follows:

"XII. (*a*) *Misleading Advertising.* No employer shall advertise or make use of sales promotion material in a manner that tends to mislead the purchasing public as to the nature, quality or quantity of the products referred to, whether of his own or competitive manufacture.

(*b*) *False Statements Regarding Policies of Competitors*—No employer shall make or cause or permit to be made or published any false or deceptive statement of or concerning the business policies, methods, conduct, ability to perform contract or credit standing of a competitor or the grade or quality of his goods.

(*c*) *Fraud and Misrepresentation as to Quality and Size*—No employer shall mark or brand products of the electrical manufacturing industry with intent to mislead or deceive, or with the effect of misleading or deceiving, customers or prospective customers in any material particular with respect to the quantity, quality, grade or substance of the products so marked or branded.

(*d*) *Threats of Suit for Patent or Trade Mark Infringement* — No employer shall circulate threats of suit for infringement of any patent or trade mark among customers of another employer if not made in good faith but for the purpose of having the effect of harassing and intimidating the customers of another employer.

(*e*) *Secret Rebates*—No employer shall secretly pay or allow any rebates, refunds, credits, or unearned discounts, whether in the form of money or otherwise, or give premiums, or extend to certain purchasers special services and privileges not extended to all purchasers under like terms and conditions, or make special allowances by way of discounts, brokerage, storage, or advertising variations from the openly announced trade or package or quantity differentials, or make delayed bills, or give full or partial discounts in cases of delayed payments, or give secret rebates or other allowances by any means or device whatsoever.

(*f*) *Consigned Stock*—The practice of consigning stock shall not be considered a violation of this code unless so provided in a supplemental code applicable to one or more branches or subdivisions or product classifications thereof.

(*g*) *Splitting Commissions* — No employer shall continue to employ any salesman or agent, compensated in whole or in part on a commission or bonus basis, who shall pay or allow to any purchaser any part of the commission or bonus earned by him in connection with the sale of any product of the electrical manufacturing industry, or who shall violate any of the unfair trade practice provisions applicable to employers in such industry.

(*h*) *Extension Warranties*—No employer in the electrical manufacturing industry shall, after a contract of purchase and sale has been executed with a purchaser, modify or extend the warranty given by such employer in such sales contract as to defects in the product covered or the liability of the employer thereunder, except with the approval of the proper Supervisory Agency.

(*i*) *False Records*—No employer shall withhold from or insert in any quotation, acknowledgment of order, invoice, or any other instrument of business procedure of the employer, whether the transaction results in an order or not, any statement which falsifies the employer's record wholly or in part.

(*j*) *Commercial Bribery* — No employer shall directly or indirectly give, or permit to be given, or offer to give, money or anything of value to agents, employees, or representatives of customers or prospective customers, or to agents, employees, or representatives of competitors' customers or prospective customers, as an inducement to influence their employers or principals to purchase or contract to purchase from the maker of such gift or offer, or to influence such employers or principals to refrain from dealing, or contracting to deal, with any other employer.

(*k*) *Giving of Prizes, Premiums or Gifts*—No employer shall offer or give to purchasers or prospective purchasers prizes, premium or gifts in connection with the sale of products or as an inducement thereto.

(*l*) *Selling Without Profit to Induce Sales of Other Products*—No employer shall sell any of the products of the electrical manufacturing industry without profit for the purpose, directly or indirectly, or with the effect, of furthering the sale of some other product manufactured by said employer.

(*m*) *Espionage of Competitors*—No employer shall secure or attempt to secure information from another employer concerning his business by any false or misleading statement or representation, or by any false impersonation of one in authority, or by bribery, or by any other unfair method."

Amend Article XIV so as to read as follows:

"XIV. Such of the provisions of this code as are not required by the Act to be included herein may with the approval of the President be modified or eliminated as changed circumstances or experience may indicate. This code is intended to be a basic code and study of the trade practices of the electrical manufacturing industry will be continued by the Code Authority, which may submit to the Administrator from time to time for approval additions to this code applicable to all employers in the electrical manufacturing industry. One or more subdivisions or product classifications of the industry may propose a supplemental code or amendments thereof or additions thereto to the Code Authority which shall submit such supplemental code, amendments or additions to the Administrator with its approval, disapproval or other recommendations within a period of thirty-five (35) days or within such longer period as may be agreed by the Code Authority and the subdivision or product classification affected. Supplemental codes and amendments thereof or additions thereto shall in all cases conform to and be consistent with the provisions of this basic code as now constituted or hereafter changed."

Amend Article XIV by adding at the end thereof the following:

"This code shall continue in effect until June 1, 1934, subject, however, to amendment at any time as hereinabove provided, and subject, also, to the reserved power of the President to cancel or modify his approval thereof as hereinabove provided. This code shall continue in effect after June 1, 1934, in the absence of the exercise of such reserved power on the part of the President, or in the absence of the exercise by the employers of the electrical manufacturing industry of the power, which they hereby reserve, to terminate this code in the manner hereinafter provided at any time after June 1, 1934.

"At any time after June 1, 1934, the Code Authority, by a majority vote of its members then in office, may submit to the electrical manufacturing industry a proposal to terminate the operation of this code on a date (to be fixed in said proposal) not less than thirty days after the expiration of said initial period. If such proposal is approved by a 66⅔ per cent. vote of employers in the electrical manufacturing industry weighted on the basis of one vote for each $50,000 of sales of products of the industry made in the preceding calendar year as reported to the Statistical Department of the Code Authority; provided, however, that each employer who reports his sales shall have at least one vote; provided, further, that the affirmative vote shall represent a majority of the qualified employers voting, the Code Authority shall so notify the President, and ten days after the giving of such notice this code shall cease to be in effect. When so terminated all subsequent liabilities and obligations hereunder shall cease.

"In presenting this code the employers in the industry do not thereby consent to any change or modification thereof unless such change or modification is submitted to and consented to by the Code Authority."

High-Tension Insulators Need Tests Before Reuse

Those difficulties which sometimes arise when salvaged materials are returned to service may be eliminated by careful, scheduled tests before installation.

To avoid premature trouble from the reuse of high-voltage (10 kv. and upward) insulators the New England Power Association has set up the following standards covering the testing and handling of salvaged insulators:

Failures of insulators in service are classified under three general headings: A—Failure from electrical stresses. B—Internal mechanical stresses due to manner of assembly. C—External mechanical loadings.

The following procedure for the reuse of insulators is recommended:

(a) Upon removal from the line each insulator should be carefully wiped and inspected for cracks or chips, the presence of either of which should be the cause for immediately disposing of the insulator. Hidden cracks can be detected only by very carefully tapping the porcelain shells with a light wooden handle. The glaze should have a uniform color and a bright and lifelike appearance.

(b) Disk insulators which are less than five years old and are of modern construction may thereupon be returned to stock and reused for all ordinary purposes. Pin-type insulators which are less than five years old and are of modern design may also be returned to stock after visual inspection provided a Doble test has been sustained in the previous six months.

(c) Insulators which are more than five years old but less than ten shall be tested as below before further use.

1. The test shall consist of the application of a 60-cycle voltage sufficient to cause vigorous flashover between the tie wire and pin, or corresponding parts on disk insulators. In case the available voltage is not sufficient to flash over the entire unit, this test may be made by flashing over single shells at a time, but in any case the use of the alternative test c2 is preferable. The failure of any shell from puncture instead of by flashover shall be cause for rejection.

In connection with this test the New England Power Company central division maintenance department at Worcester has available a portable testing transformer which can be sent to any point where a large number of units require testing. In the case of the usual quantities, however, it is advisable to send the units to Worcester for test.

2. As an alternative for the flashover test, a Doble test may be made when current is available from a source which will maintain full rated line voltage without effect by leakage over or through the porcelain. Such test may be made on a frame where provision is made to simulate field conditions with the insulator support solidly grounded. Test readings should be equivalent to new insulators of equal rating.

3. In case large numbers of insulators are to be removed from service, it may be less expensive to Doble-test the whole installation in place immediately before removal is started and dispense with the test c1 or c2. In such case visual inspection for chips or cracks must not be relaxed and extra care used in handling those units which are suitable. It is also necessary to observe the precaution mentioned under (f).

4. Whichever test is most convenient should be done only under the personal supervision of a competent and experienced test man.

(d) No restriction should be placed on the voltage at which second-hand insulators may be used after having passed the above test, except those which apply on standard insulators for the same service; i.e., the manufacturer's rated wet and dry flashovers shall not be less than those required under standard practice.

(e) Insulators accepted into stock for further use, after either visual or electrical test, should thereafter receive careful handling, since such insulators are damaged to a greater extent by rough handling than new crated or boxed insulators.

(f) If at all feasible, all second-hand insulators should be given a Doble test soon after reinstallation, since the redistribution of mechanical stress sometimes causes failure in aged porcelain and such failure may occur after the insulators have been tested for stock.

(g) Insulators exceeding ten years of age should be reused only with the greatest caution. Experience has indicated that the expectancy of trouble-free service from units made before 1923 is about twelve to fifteen years. The reuse of such insulators is therefore a doubtful economy due to the expense of changing units which go bad within a brief period. This expense in most cases will equal or exceed the cost of a new insulator.

Broadcasting Studios Present Interesting Lighting Problems

One of the N.B.C. studios lighted to 16 ft.-candles

Acoustical considerations, necessity for restfully adequate illumination, complete reliance on artificial light, flexibility and heat control are factors.

By A. L. POWELL
Supervising Engineer
Incandescent Lamp Department
General Electric Company

EARLY broadcasting studios were by no means designed for this exclusive function; the first broadcasting was done from any vacant office or unused laboratory that happened to be available. The new studios of the National Broadcasting Company in Radio City, however, in contrast have been carefully planned well in advance. Every precaution has been taken to make provision for the future and insure the best that present-day practice can provide. Acoustical treatment, air conditioning, decorative schemes, and similar items were each studied in detail. Dependence is placed entirely on artificial illumination and rigid specifications were set forth.

The designing engineers were well informed on the relation of lighting to seeing and realized that high level illumination well distributed would reduce the number of mistakes which might occur, speed up the ability to see and prevent eye strain, fatigue and nervousness. A standard of approximately 20 foot-candles was established and it was required that the distribution be such as to give adequate light from several directions in all parts of the room. Such an arrangement permits maximum flexibility in the placement of orchestral, choral and dramatic groups. It was further desired to select a type of unit which accurately controls the distribution to prevent direct and reflected glare.

The acoustical engineers would not permit the ordinary type of lighting fixture, believing that this foreign element might set up objectionable vibrations. It was necessary to choose a form of luminaire which would emit its light through some medium flush with the ceiling surface.

A "Holophane" prismatic controlens, 12 in. square (No. 755 VF) was selected. This was mounted in a cast-aluminum frame hinged to a No. 14 gage galvanized steel box. In the box is mounted a 200-watt "Mazda" lamp, on an adjustable socket, in a prismatic bowl reflector.

A still further exacting requirement was presented. The air-conditioning ducts are in the space above the hung ceilings and it was believed that radiant and conducted heat striking these ducts would make control of temperature very difficult. Since the thermostatic devices for heat control are in the studio itself, it was decided to insulate the lighting boxes from the ceiling space and cause all the heat to be radiated into the studio itself and there to be dissipated. Each box was accordingly surrounded by a 4-in. curb containing thermo-fill and special asbestos and metal baffles are placed inside to prevent heat from being transmitted.

Service flexibility necessary

Throughout the building ceiling heights were quite varied and structural elements, such as beams, air ducts, and the like, prevented any standardized arrangement of outlets. Each of the studios was considered as a separate problem and careful calculations made as to spacing, wattage, distribution, etc. As a result, there are four different combinations of the standard unit applied, namely, single, double, triple and quadruple.

The particular studio shown is a two-story room starting from the third floor. The floor space is 40 x 26 ft. and the ceiling height 18 ft. The ceiling is finished in light cream, the floor covered with tan linoleum, the side walls light tan with green and gold fabric panels. This studio is lighted to a level of 16 ft.-candles from 28 recessed prismatic plate units of the single type with 200-watt lamps.

Inasmuch as television is anticipated for the future, it was felt that a.c. lighting might produce a stroboscopic effect, so direct current is used in the studios. Space does not permit an analysis of the entire project, but some idea of the size may be had from the statement that a total of 700 20-watt units are required for the studios alone.

The South Welcomes the T.V.A.

Millions of dollars into the pockets of wage earners awaken the South to new energy.

Impressions of the Tennessee Valley Authority, its work, its reception and its personnel.

MID-SOUTH is enjoying more prosperity than it has had for many years and is confident that recovery is on the way. This is the impression gained from an extended editorial visit through the Carolinas, Georgia, Alabama, Mississippi and Tennessee. The business executive, the merchant, the utility official, the politician and the man on the street all agree that business in the South is looking up and that the people have an energy and a spirit that are very promising.

What causes the favorable conditions? One prominent official says: "The primary reason is the governmental expenditures down here. There is more money in circulation than has existed since the Civil War. The NRA, the C.W.A., the P.W.A., the plow-up campaign, the 10-cent cotton loans and cotton options, the A.A.A. programs and the T.V.A. expenditures have brought around $300,000,000 of new money into circulation. In addition, tobacco and cotton prices have increased, textile plants are operating and the chemical, metal, dairy, food and other industries are fairly busy. Undoubtedly the increase in wage scales accompanying these activities has put more money into the pockets of the mass of the people than they ever had before and they are spending it." Added proof is found in the fact that most of the states now are able to pay their current expenses and to collect taxes. And a study of the energy outputs of the utilities shows that this year has started with kilowatt-hour sales in excess of all past records.

Utilities meet the test

WHAT about the utilities? In most cases they are doing and feeling much better. They have settled immediate troubles and have handled the emergencies created by the T.V.A. intelligently. In general they have satisfied the public demand and reduced rates greatly, particularly domestic rates, and this has created an immediate necessity to sell more business and this is their present goal. Undoubtedly the first effect of the T.V.A. project was to increase the pressure for these rate reductions, but in many respects it is now a stimulating influence, if it is felt at all. The private utilities are co-operating with the T.V.A. and not fighting it, and T.V.A., in turn, is co-operating with them, as is evident from the recent mutually beneficial contract between the Commonwealth & Southern and the T.V.A. In addition they are working together on the E.F.H.A.

When T.V.A. began line construction

Late in December the authority started erection of the first rural line. Standing by the first pole are Llewellyn Evans, chief engineer, and David Lilienthal, a member of the authority.

development. The utilities are concentrating upon load building and are not worrying about the T.V.A. half as much as are utilities in other sections.

But the focal point of this visit was the T.V.A. project itself. For, as one of the T.V.A. officials said: "It is remarkable how the public imagination has seized upon this project. Newspaper men, feature writers and other visitors come down here in droves to get information to supply the public demand." What has been done and what will be done is the customary burning question.

Personal inspections and interviews with people in all parts of the valley from Muscle Shoals to Norris Dam give a vivid impression of the T.V.A. activities and of the favorable local sentiment with which they are received. There are all sorts of reactions. The cotton farmers and the mountaineers do not understand just what the project means, but they welcome it and expect some direct benefits. It is the chief topic of conversation in the villages this winter as they congregate for a visit, accompanied by the inevitable hound dog and shotgun. The politicians in local towns and cities are very friendly and are eager to get some money spent in their communities, to get some branch of T.V.A. activity located in

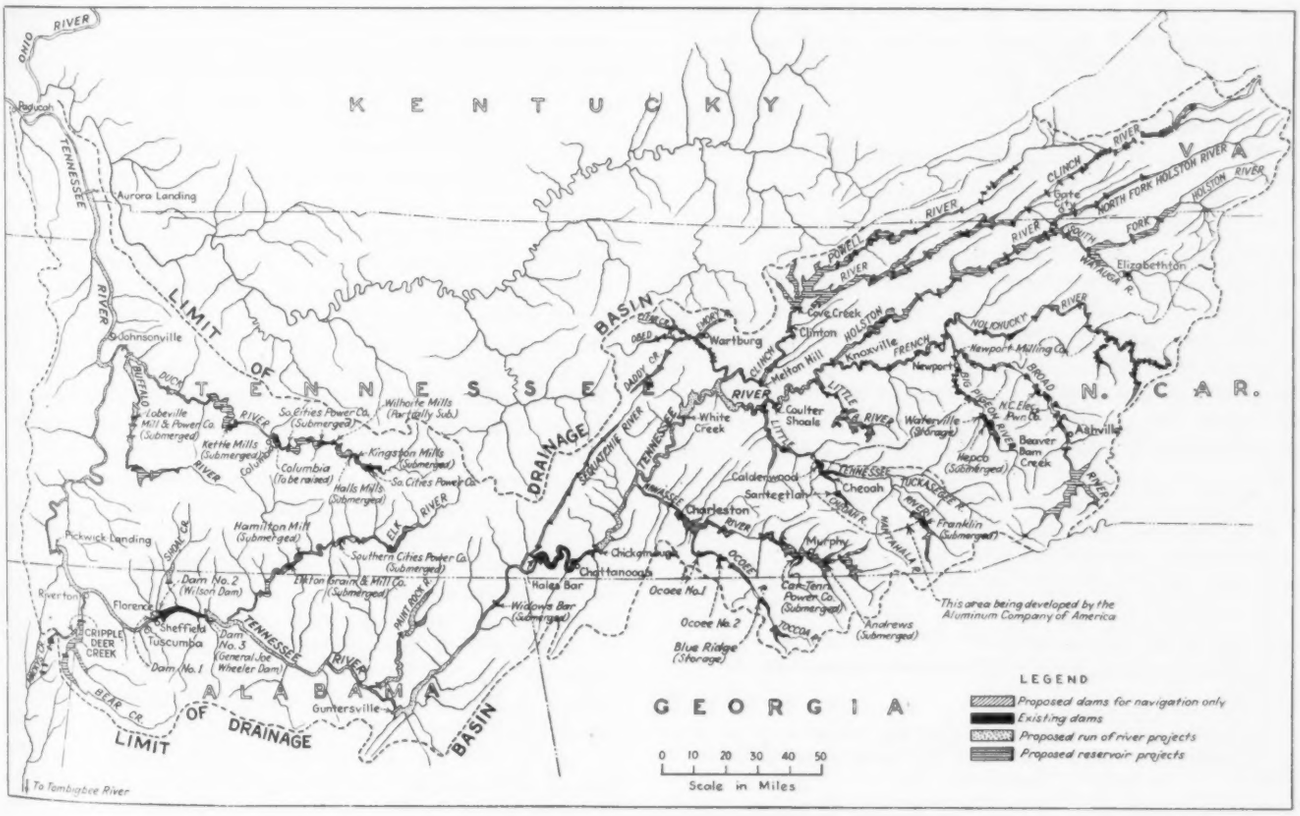
their towns and to get jobs for friends or for themselves. The retail merchants are happy because they expect to get more sales. The electrical manufacturers' salesmen, the wholesalers and the electrical dealers are happy because they see a chance to sell more products. All is favorable expectancy, but, unfortunately from the point of view of T.V.A. executives, this expectancy brings a pressure for immediate results on a project that requires planning and time for successful accomplishment. Some disappointments are inevitable.

T.V.A. engineering progresses

WHAT is T.V.A. trying to do? For one thing it is ordered to build power dams and transmission lines and it is doing this. Cofferdams for the $35,000,000 Norris Dam and the $15,000,000 Wheeler Dam are finished already and work continues. A 44-kv. line has been built from Muscle Shoals to Wheeler Dam. Other short transmission and distribution lines have been built in this vicinity. The design of a 154-kv., 200-mile line from Muscle Shoals to Norris Dam is about complete, a stranded aluminum conductor with a single strand steel core has been delivered, the insulators are ordered and much of the right-of-way has been cleared. The design favored at present is an H-frame wood-pole structure, without ground wires, for use in the lowlands, but steel towers probably will be used in the mountains. There are, as yet, no standard designs for the proposed 13-kv. rural lines, the 44-kv. secondary lines and the 154-kv. trunk lines that will form the backbone for power supply, but the work is under way and engineers at Muscle Shoals, at Knoxville and in the field are working hard and enthusiastically to get ready plans and specifications. The hope is to complete the 154-kv., 200-mile line from Muscle Shoals to Norris Dam by June.

Also, T.V.A. is studying all available dam sites and is preparing budgets for building future dams. There are 200 dams on 1,900 miles of waterway ultimately in this billion-dollar project. But the order of building dams and the budgets for each year are not yet determined.

The T.V.A. has not formulated its complete power plan and organization. In principle it wishes to generate and distribute upon a wholesale basis. However, it has purchased distribution systems in the towns in northern Mississippi and is operating them as well as rural lines there and in other localities. In the northern Alabama purchased territory it wholesales only. For rural use it is proposed that farmers, with an initiation fee of $25 each, organize into rural electrical associations incorporated under state laws to buy T.V.A. power at wholesale and then retail it to their members. This idea is not in operation as yet and if any better plan can be devised it will be used. The minimum rates suggested for rural users are: Two to five customers per mile, $1.20 per month; five to ten customers per mile, 75 cents per month; ten customers or more per mile, 60 cents per month. For the first 50 kw.-hr. per month, including the minimum, 3 cents per kw.-hr.; for the next 150 kw.-hr., 2 cents per kilowatt-hour; for the next 200, 1 cent, and for all over 400, 4 mills. It is estimated that wiring costs for minimum service for each house will not exceed $25 and the lines built with government funds are costing on an average $800 per mile. For cities there will be little difficulty in doing business on a wholesale



Intensive demonstrations of the T.V.A. planned economy are concentrated at Muscle Shoals, at Norris Dam and in central Tennessee

A Striking Cross-Section of the Present Living Standards and Economic Position in the Tennessee Valley

Seven States Combined: Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, Virginia

The Fifteen Richest Counties								The Fifteen Poorest Counties							
County	State	Assessed Valuation 1922	County Tax Rate 1922	County Revenue Produced 1922	Children of School Age 1920	Illiteracy of Native Whites 1920	Urban Population 1920	County	State	Assessed Valuation 1922	County Tax Rate 1922	County RevenueProduced 1922	Children of School Age 1920	Illiteracy of Native Whites 1920	Urban Population 1920
Jefferson	Ky.	$329,641,000	$0.44	$1,463,000	67,073	1.5	242,068	Dawson	Ga.	$721,000	$1.53	$11,000	1,342	12.3	0
Shelby	Tenn.	276,087,153	0.93	2,567,610	69,450	0.7	162,351	Towns	Ga.	811,000	1.36	11,000	1,301	9.0	0
Richmond City	Va.	274,246,000	1.56	4,280,000	42,574	1.0	171,667	Glascock	Ga.	709,000	2.12	15,000	1,410	4.1	0
Jefferson	Ala.	237,969,000	1.28	3,052,000	87,847	2.2	206,148	Union	Ga.	970,000	1.96	19,000	2,646	11.9	0
Fulton	Ga.	216,896,000	1.00	2,169,000	59,842	1.7	201,049	Quitman	Ga.	982,000	1.12	11,000	1,264	4.7	0
Davidson	Tenn.	198,572,868	0.94	1,866,585	51,159	2.1	118,342	Chattahoochee	Ga.	1,098,000	1.28	14,000	1,346	2.5	0
Norfolk City	Va.	174,979,000	1.83	3,198,000	27,097	1.1	115,777	Pickett	Tenn.	1,259,060	1.03	12,968	1,943	13.8	0
Forsyth	N. C.	151,957,000	0.45	684,000	23,538	6.3	48,395	Echols	Ga.	1,380,000	1.38	19,000	1,098	7.5	0
Hamilton	Tenn.	142,587,410	1.04	1,482,909	34,287	3.5	69,525	Milton	Ga.	1,396,000	1.58	22,000	2,399	10.1	0
Guilford	N. C.	138,500,000	0.68	942,000	24,485	4.1	34,163	Lumpkin	Ga.	1,439,000	1.04	15,000	1,726	15.1	0
Knox	Tenn.	126,482,034	0.74	885,374	44,145	5.8	77,808	WilliamsburgCity	Va.	1,517,000	1.98	30,000	.....	.....	2,462
Mecklenburg	N. C.	122,612,000	0.76	932,000	24,346	3.5	46,338	Heard	Ga.	1,527,000	2.23	28,000	3,884	11.8	0
Buncombe	N. C.	93,041,000	0.84	782,000	18,777	4.8	28,504	Elliott	Ky.	1,530,000	0.85	13,000	3,176	13.0	0
Fayette	Ky.	85,897,000	0.66	570,000	12,941	3.5	41,534	Lanier	Ga.	1,561,000	1.47	23,000	.....	.....	0
Wake	N. C.	83,685,000	0.62	519,000	23,254	6.8	24,418	Greene	Va.	1,602,000	1.44	23,000	2,238	21.9	0
Total		2,653,152,465		25,393,478	610,815		1,588,087	Total		18,502,060		266,968	25,773		2,462
Average		176,876,831	0.96	1,692,899	40,721	2.6	105,872	Average		1,233,471	1.44	17,798	1,983	11.8	16.4
Ratio		99.3	40.0	99.0	96.0	18.1	99.8	Ratio		0.7	60.0	1.0	4.0	81.9	0.2
% of Total or Average for the Seven States		23.0	.....	24.2	11.5	40.6	40.9	% of Total or Average for the Seven States		0.16	.....	0.25	0.48	184.4	0.06

basis and the typical contracts are those given to Tupelo and Knoxville, which have identical prices and provisions.

Until Norris Dam is finished the power part of the program will be restricted, as will other parts, to sample areas. One of those will be in the vicinity of Muscle Shoals, another in Knoxville and the vicinity of Norris Dam and another in central Tennessee. These sample areas will give practical experience in the integration of the power program with the other aspects of the project. At present, therefore, aside from the Muscle Shoals-Norris Dam line, there will be no great geographical expansion of whole power facilities.

Co-ordinated plan developed

It should be remembered that power is only a part of the great social experiment. It must be integrated with the other purposes. This project is planned by the T.V.A. as a national plan of social and industrial life. It is not for the benefit of the Tennessee Valley only. In the minds of the T.V.A. executives it is good or bad in the degree that what is worked out there can be applied on a nationwide scale. Some of the things to be done are:

1. Improve agriculture.
2. Develop new industries.
3. Provide navigation facilities.
4. Make and use fertilizer.
5. Control floods.
6. Use the natural resources.
7. Provide for reforestation.
8. Make electric power and electric services available to all at low cost.
9. Prevent soil erosion.
10. Make a self-sustaining community with decentralized industry and diversified labor that will bring about high standards of living.

Thus the problems of the T.V.A. are the problems of America. The entire plan must start from scratch. The vast majority of the people have an income of less than $100 a year, the soil is thin and worn because of past agricultural methods and erosion following deforestation, industries are few and small, habits of living and acting are traditional and have been adapted to comparatively low economic standards. The conditions range from the almost primitive life of the mountaineer down through the lowlands to the life of the tenant cotton farmer. The favorable conditions are that there is an American-born population of good stock and there are diversified resources as yet undeveloped.

But this planned economy, this rehabilitation of an area, this multi-sided project cannot get results in a day, and the T.V.A. executives realize this far better than the public. They are getting data, studying possibilities and changing their organization from day to day to meet the facts. In order not to waste effort they plan to use sample areas for intensive effort and study. Seventeen counties in the area near Muscle Shoals, three counties in middle Tennessee and Knoxville with the counties above Norris Dam give three representative samples of people, of occupations and of terrain to work out and demonstrate the plans.

The great impression gained from a visit to the T.V.A. is that it is essentially an experimental social project to displace a haphazard, unplanned and unintegrated economy with one based upon plan, completeness and human welfare. Power is an essential in this program, but at present the real problems of the T.V.A. lie in other aspects of the project and one wonders at, yet applauds, the eager enthusiasm with which those in charge of the activities face apparently unsurmountable social and economic difficulties. This project is truly in the spirit of a desire for a better civilization, but at this time actual accomplishments of major magnitude have not been made and could not be expected. The project is in a fact-finding and preliminary organization stage, aside from the actual work on dams and lines.

Service Reliability Measured by Probabilities of Outage

By S. A. SMITH, JR.
Assistant Engineer Transmission
Public Service Electric & Gas Company, Newark, N. J.

Does it cost more than it is worth to make a 270,000-kw. generating station so good that due to outages only 295 kw.-hr. of revenue output will be lost per year? That is certainly a high order of reliability, found by the method of probability analysis developed in this article.

Perhaps the probability of outage has not guided the provision of reserve against such outages as much as it should have done. Systems with few cables or generators or transformer units have carried too small reserve and the large many-unit systems too many such spares.

In a previous article (February 10, 1934, page 222) Mr. Smith set up the elementary ideal problem. This one moves on to a practical case.

IMPORTANT now, but especially so in the near future, is the question of spare capacity. So long as power systems are operating at loads below the levels of former years, and are as a consequence somewhat overbuilt, service reliability in so far as it depends on reserve capacity is no pressing problem. But there may exist situations in which it is possible and desirable to close down inefficient plants. In such cases it is decidedly of value to estimate by some rational means the point at which retirement of spare or standby equipment will begin unduly to jeopardize continuity of service.

Looking to the future, when further load growth sets in, an understanding of the application of probability theory to the problem of spare capacity should do much to assure continuing high standards of service and at the same time prevent unnecessary extension of plant facilities.

A hypothetical generating system consisting of twelve units of various sizes, having 35 per cent reserve capacity for an annual peak load of 200,000 kw., and operating on a typical annual duration curve, has been studied in the light of this method and its reliability has been measured in terms of the expected yearly kilowatt-hours load loss. If the kilowatt-hour is the proper unit in which to measure load interruption, and if a money value can be assigned to it, then it becomes a simple matter to say whether the quality of service rendered is or is not justified from an economic point of view. While it is the writer's belief that at least a rough value for the interrupted kilowatt-hour and the quality of service can be assigned, it is not within the scope of this article to attempt to do so. However, for a generating system of the size studied it is probably safe to state that a computed expected loss of 295 kw.-hr. annually is better than need be. The conclusion should be either that the system could carry more load with the existing capacity, or that one or perhaps two of the smallest units could be temporarily put on a cold reserve basis.

ANALYSIS such as is presented may be made for any actual system provided basic data on failures, repair time and load duration can be obtained. The expected kilowatt-hours load loss may be worked out for proposed increases or reductions in the number of generating units, or the calculations may be predicated on estimates of load increase or decrease. Such analysis should be particularly useful in evaluating the gain in reliability to be obtained from the interconnection of systems, or if no increase in reliability is justified calculation can be made to determine the amount of equipment which can be eliminated after interconnection is effected.

Method based on statistical equilibrium

In a previous article* the subject of probability theory and its application to power system design was discussed in general terms and a simple method of solving an elementary type of problem was presented.

The present article explains another practical and more flexible method which has had important applications in telephone exchange problems, but has not hitherto, so far as the writer is aware, been adapted for use in the power field. Extensive use of this procedure can be made in the solution of problems of spare power equipment of all kinds, but for purposes of illustration the present discussion will be confined to the generating units of a hypothetical supply system in which it is desired to compute the probabilities of simultaneous machine outages, and from these to obtain a measure of service reliability.

The method is based on the simple but important concept of "statistical equilibrium," which may be stated as follows:

If repeated observations could made on a very large number of generating systems, each system consisting of the same number of units and each unit having the same characteristics determining its likelihood of failure, it would be found that the

*"*Spare Capacity Fixed by Probability of Outages,*" ELECTRICAL WORLD, *February 10, 1934, page 222.*

proportion of systems in which any given number of units, x, were at any instant simultaneously unavailable, would have a value independent of the particular time of observation. From this it follows that the number of systems which during a short interval of time changed from having x units out of service to having $x+1$ units out of service must have been counterbalanced by approximately the same number of systems having made just the reverse change in state; that is, from having had $x+1$ units out of service to having x units out.

In more direct terms, assuming we could look at 10,000 systems, each of which had, say, twelve generators, we should always observe that some systems were operating with all their units available, that some systems had one unit unavailable, that others had two unavailable, that a few had three out, a very few four, and so on, and we should further observe that the proportion of systems having, say, two units out was always approximately the same. From this we should be obliged to conclude that as certain systems changed from having had two units out of service to having three out, in a like number of other systems which had three units out a unit was repaired and returned to service, thereby reducing the number of units out in those systems from three to two.

Founded on two probabilities

Considering now a single system, if a is the average number of times a single generating unit fails during an extended period of operation T, the probability that during any short interval of time dt the unit will fail is $\frac{a}{T}\,dt$. If n units are running the probability that one of them will fail during the interval dt is practically n times as great, or $\frac{na}{T}\,dt$.

If a damaged unit requires an average length of time, r, for repairs or replacement, the "rate" at which the unit will be returned to service is $\frac{1}{r}$ and the probability of its being returned to service in the interval dt is $\frac{1}{r}\,dt$. If x units are under repair the probability that one of them will be returned to service in the interval dt is practically x times as great, or $\frac{x}{r}\,dt$. If, now, dt is made so small that only one change of state can occur, the following equation may be written:

$$\frac{na}{T}\,dt\,f(x-1) = \frac{x}{r}\,dt\,f(x) \qquad (1)$$

in which $f(x\text{-}1)$ represents the probability that exactly $x-1$ units are out of service, and $f(x)$ the probability that x units are out.

The left-hand side of equation (1) represents the product of two probabilities: First, the existence probability of a certain state or condition—that is, the probability that $x-1$ units will be out of service denoted by the symbol $f(x-1)$, and, secondly, the probability of a change in that state during dt, that is, the probability denoted by $\frac{na}{T}\,dt$ that one unit will fail, increasing the number of units out from $x-1$ to x. Similarly, the right-hand side of the equation expresses the product of the probability $f(x)$ that x units will be out of service, times the probability $\frac{x}{r}\,dt$ that one of these x units will be repaired and returned to service during dt, thus reducing the number of units out from x to $x-1$. By the concept of statistical equilibrium these two compound probabilities are equal.

For convenience, letting $m = \frac{a}{T}$ = rate of failure per unit of service time, equation (1) may be written:

$$nm\,f(x-1) = \frac{x}{r}\,f(x) \qquad (2)$$

Method applied to practical case

A hypothetical example may now be considered:

A system having an annual peak load of 200,000 kw. has installed generating capacity of 270,000 kw., consisting of twelve units operating in parallel and connected by adequate buses and tie lines. The capacities of the individual units are assumed to be:

	Kw. Each
Nos. 1, 2, 3	30,000
Nos. 4, 5, 6	25,000
Nos. 7, 8, 9	20,000
Nos. 10, 11, 12	15,000

The larger machines will be considered the most effi-

Table I—Two Minutes Annual Inability of 12-Unit System to Maintain Service

Fifty-nine of the 120 combinations of three units unavailable at one time will entail the loss of more than 70,000 kw. in capacity to meet a 200,000-kw. peak with 270,000 kw. in the station. Similarly the outage-hours entailed by other combinations of unavailable units are tabulated below to a total of 0.034 hour.

(1) System Load Kw. ÷ 1,000	(2) Hours Duration Per Year	(3) Machines Scheduled	(4) Capacity Scheduled Kw. ÷ 1,000	(5) $f(3)$	(6) π_3	(7) $\pi_3 f(3)$	(8) $f(4)$	(9) π_4	(10) $\pi_4 f(4)$	(11) $f(5)$	(12) π_5	(13) $\pi_5 f(5)$	(14) Summation $\pi_x f(x)$ $x = 3$ to $x = 5$	(15) Hours Load Outage Expected (2)x(14)
195–200	5	10	240	0.003334	59/120	0.001639	0.000225	210/210	0.000225	0.000011	252/252	0.000011	0.001875	0.009375
190–195	7	9	225	0.002505	28/84	0.000835	0.000169	126/126	0.000169	0.000008	126/126	0.000008	0.001012	0.007084
185–190	10	9	225	0.002505	10/84	0.000298	0.000169	126/126	0.000169	0.000008	126/126	0.000008	0.000475	0.004750
180–185	13	9	225	0.002505	1/84	0.000030	0.000169	123/126	0.000165	0.000008	126/126	0.000008	0.000203	0.002639
175–180	18	9	225	0.002505	0/84	0.000000	0.000169	111/126	0.000149	0.000008	126/126	0.000008	0.000157	0.002826
170–175	31	8	205	0.001812	0/56	0.000000	0.000109	56/70	0.000087	0.000005	56/56	0.000005	0.000092	0.002852
165–170	36	8	205	0.001812	0/56	0.000000	0.000109	35/70	0.000055	0.000005	56/56	0.000005	0.000060	0.002160
160–165	50	8	205	0.001812	0/56	0.000000	0.000109	14/70	0.000022	0.000005	56/56	0.000005	0.000027	0.001350
155–160	65	8	205	0.001812	0/56	0.000000	0.000109	3/70	0.000005	0.000005	56/56	0.000005	0.000010	0.000650
150–155	80	7	185	0.001252	0/35	0.000000	0.000066	0/35	0.000000	0.000002	21/21	0.000002	0.000002	0.000160
145–150	95	7	185	0.001252	0/35	0.000000	0.000066	0/35	0.000000	0.000002	21/21	0.000002	0.000002	0.000190
													Total	0.034036

Approximately 2 minutes per year.

$f(x)$ = probability that x units will be simultaneously unavailable.
πx = probability that if x units are unavailable load outage will result.
$rm = 0.03$.

cient; the smaller ones the least efficient. The arbitrary requirement will be set up whereby the capacity of machines actually running equals, at all times possible, the load plus at least 30,000 kw. Thus at the yearly peak the scheduled capacity running will be not less than 230,000 kw. This can be approached by holding two of the least efficient machines, Nos. 11 and 12, in reserve and running the remaining ten to obtain a capacity of 240,000 kw.

The first part of the problem comprises the determination of the probability of outage at the time of the peak, and then, knowing the number of hours of operation at peak load, computing the expected load outage.

With an installation of twelve machines there may exist any one of thirteen conditions, viz., no units unavailable, one unit unavailable, two units unavailable, and so on to twelve units unavailable. The summation of the probabilities of these thirteen conditions must equal unity, or certainty, since no other condition respecting the availability of units can conceivably exist. Expressed mathematically, this statement becomes:

$$f(0)+f(1)+f(2)+\ldots\ldots+f(12)=1 \qquad (3)$$

Since at peak load with all machines available only the ten schedules are actually running, it can be assumed that failures which may occur will be confined to these ten. The general equation (2) may be written:

$$10\,m\,f(0)=\frac{1}{r}f(1),\ \text{or}\ f(1)=\frac{10rm}{1}f(0) \qquad (4)$$

Ten units will also be running whenever one or two units are unavailable. Therefore:

$$10\,m\,f(1)=\frac{2}{r}f(2),\ \text{or}\ f(2)=\frac{10rm}{2}f(1)=\frac{(10)^2(rm)^2}{1\cdot 2}f(0) \qquad (5)$$

and

$$10\,m\,f(2)=\frac{3}{r}f(3),\ \text{or}\ f(3)=\frac{10rm}{3}f(2)=\frac{\frac{(10)^3(rm)^3}{(10)^3(rm)^3}}{1\cdot 2\cdot 3}f(0)$$

But whenever three units are unavailable only nine units can run, and so:

$$9\,m\,f(3)=\frac{4}{r}f(4),\ \text{or}\ f(4)=\frac{9rm}{4}f(3)=\frac{(10)^3(9)(rm)^4}{1\cdot 2\cdot 3\cdot 4}f(0)$$

And whenever four units are unavailable only eight units can run:

$$8\,m\,f(4)=\frac{5}{r}f(5),\ \text{or}\ f(5)=\frac{8rm}{5}f(4)=\frac{(10)^3(9)(8)(rm)^5}{1\cdot 2\cdot 3\cdot 4\cdot 5}f(0),$$

and so on to:

$$m\,f(11)=\frac{12}{r}f(12),\ \text{or}\ f(12)=\frac{(10)^3\,9!\,(rm)^{12}}{12!}f(0)$$

Substituting the expressions for $f(1)$, $f(2)$, $f(3)$, etc., in terms of $f(0)$ in equation (3) and solving for $f(0)$:

$$f(0)=\frac{1}{1+10rm+\frac{(10)^2(rm)^2}{2!}+\frac{(10)^3(rm)^3}{3!}+\frac{(10)^3(9)(rm)^4}{4!}+\text{etc.}}$$

For ordinary values of rm the final terms in the denominator become so small relative to unity that they may be omitted without introducing appreciable error.

Substituting the expression for $f(0)$ in equation (4), the expression for $f(1)$ becomes:

$$f(1)=\frac{10rm}{1+10rm+\frac{100\,(rm)^2}{2!}}$$

Similarly from equation (5):

$$f(2)=\frac{\frac{100(rm)^2}{2!}}{1+10rm+\frac{100(rm)^2}{2!}}$$

It will be observed that the expression rm is in reality the ratio of a unit's repair hours to its service hours, since m = the number of failures per unit of service time, and r = the average length of repair time per failure. A reasonable value for this ratio in the case of generating units is 3 per cent.

Evaluating $f(x)$ for various values of x and for $rm = 0.03$:

$f(0) = 0.740\ 840$	$f(4) = 0.000\ 225$
$f(1) = 0.222\ 252$	$f(5) = 0.000\ 011$
$f(2) = 0.033\ 338$	
$f(3) = 0.003\ 334$	$1.000\ 000$

The summation $f(6) + f(7) + \ldots + f(12)$ is negligible in this case, not appearing before the seventh place of decimals.

Interruption occurs with loss of three units

No interruption to service occurs when no units, or one unit, or two units, are out of service. When, however, at the time of the peak load three units are unavailable an interruption will occur provided the capacity of the three units exceeds the installed spare, or 270,000 kw. — 200,000 kw. = 70,000 kw. Certain combinations of three units will amount to more than, and certain combinations less than, 70,000 kw. If it be assumed that the three units out of service are among machines Nos. 1 to 10, inclusive, the probability of these three amounting to more than 70,000 kw. is easily calculable.† Taking ten units three at a time the number of combinations which may be formed is $\frac{10!}{7!\,3!} = 120$. An inspection of these combinations reveals that 59 of the 120 amount to more than 70,000 kw. Since one combination can be assumed as likely to occur as another, the probability that load will be dropped when three machines are out is $\frac{59}{120}$

Whenever four machines are unavailable at the peak an interruption is almost certain to occur, since any combination of four units among the first ten aggregates more than 70,000 kw. The same is of course true whenever five or more units are unavailable.

The total probability of load outage at the time of the peak is then:

$$0f(0)+0f(1)+0f(2)+\frac{59}{120}f(3)+f(4)+f(5)+\ldots.+f(12)$$

Evaluated, this becomes:

$$\left(\frac{59}{120}\right)(0.003334)+0.000225+0.000011+\ldots.=0.001875$$

†*It is possible, of course, that one of the original idle units which replaced the first failed unit may itself fail and become the second failed unit. The chances are against this and the assumption is justified, particularly as it errs on the side of conservatism.*

If the duration of the peak is five hours per year, the expectation of load loss at the time of the peak becomes (0.001875)(5) = 0.009375 hours per year (approximately ½ minute per year).

Table I gives the summary of the calculation just made, together with probabilities and expectations similarly calculated for various periods during which the load is below the peak value. It will be noted that the load outage expectations fall off rapidly as loads decrease in amount from the peak value. In fact, for the load durations assumed it is not necessary to consider loads below about 75 per cent of the peak, because, even though these lower loads obtain during the greatest part of the year, the probabilities of load outage shrink to insignificant proportions as, with lower loads, the available spare capacity increases. It should be remarked, however, that there may be critical situations at off-peak periods due to reductions in capacity brought about by annual inspection and maintenance of generators and turbines and by scheduled condenser cleaning. For the duration of periods when, for example, two machines are undergoing regular prearranged maintenance, the system described would be considered as having only ten (instead of twelve) machines installed, and if it appeared necessary probabilities and expectations would be calculated on this basis. Consideration of these situations will be omitted in this solution.

The total expectation of load outage is, then, for this system, the total of column (15) of Table I, or about two minutes per year. The significance of this value should be understood. It does not, of course, mean that every year load will be dropped for just two minutes. It means that if the system were operated under the same essential conditions for a great number of years, or if a great number of similar systems were operated concurrently, the most likely average duration of load interruption per year per system would be two minutes. A single such system might operate for many years in succession without any loss of load, but in the very long run its average interruption should approach the figure given.

So far service reliability has been evaluated only in terms of the duration of interruptions and not in terms of kilowatts of load affected. It is suggested that the best measure of service reliability is the kilowatt-hours of energy interrupted, since such a quantity combines the effect of duration and magnitude.

It is not difficult to make this kind of evaluation for the system under examination. Consider, for example, the situation when the load is between 195,000 and 200,000 kw. Ten machines are scheduled. If three of these ten become unavailable load interruption will occur provided the combined capacity of the three exceeds 70,000 kw., the total spare and reserve capacity. As has been shown, there are 120 possible and equally probable combinations that can be formed with ten units taking three at a time. The second column in Table II shows the capacities to which three machines may total, the first column the number of possible combinations which will give these various capacities, and the third column the capacities remaining to carry load. Assuming the load averages 197,500 kw., the deficiencies in capacity are shown in the fifth column. These figures represent loads which may be dropped, and the average of this column weighted by the number of combinations shown in the first column gives 2,850 kw., the probable load interruption if and when three machines are available. Since the load is in the 195,000-200,000-kw. range for five hours per year the indicated energy loss is (2,850)(5) = 14,250 kw.-hr. But the probability that three units will be simultaneously unavailable when ten are scheduled has been found to be 0.003334 (see Table I). Thus the expected energy outage for the particular situation considered is reduced to (14,250)(0.003334) = 48 kw.-hr. per year.

Similar calculations for other load ranges and for cases of four and five units unavailable are summarized in Table III. The total expected annual energy loss due to independent and random outage of generating units is thus found to be 295 kw.-hr. This figure is the measure of the system's reliability.

Table II—Probable Amount of Load Dropped With Load Range 195,000-200,000 Kw. and Three Units Unavailable

(1) Number of Combinations	(2) Aggregate Capacity Unavailable, Kw.	(3) Capacity Available, Kw.	(4) Average Load, Kw.	(5) Capacity Deficiency, Kw.
1	90,000	180,000	197,500	17,500
9	85,000	185,000	197,500	12,500
18	80,000	190,000	197,500	7,500
31	75,000	195,000	197,500	2,500
27	70,000	200,000	197,500	0
21	65,000	205,000	197,500	0
10	60,000	210,000	197,500	0
3	55,000	215,000	197,500	0
120			Weighted average =	2,850

Table III—Time Outages for All Loads Converted to Kilowatt-Hours of Lost Output

(1)	(2)	(3)	(4)	(5)
	Expectation of Load Loss Kw.-Hr per Year			
Load Range Kw. ÷ 1,000	When Three Units Are Unavailable	When Four Units Are Unavailable	When Five Units Are Unavailable	Total
195–200	48	26	3	77
190–195	26	27	3	56
185–190	9	30	3	42
180–185	1	28	4	33
175–180	0	24	5	29
170–175	0	19	5	24
165–170	0	10	5	15
160–165	0	4	5	9
155–160	0	1	5	6
150–155	0	0	2	2
145–150	0	0	2	2
Totals	84	169	42	295

Industrial Revival Reflected

Detailed allocation of energy sales of large electric systems in the United States and Canada will be tabulated in the Annual Supplement to ELECTRICAL WORLD now in preparation.

About two-thirds of the returns have been received and numbers are coming in daily. Most of them show a somewhat larger output than in 1932, the gains being mainly in wholesale energy sales. These in some cases run as high as 20 per cent. In domestic use losses and gains are mixed; in retail commercial sales moderate losses predominate. A 10 per cent increase in one company's domestic sales is exceptional, but readily accounted for; it was in the District of Columbia.

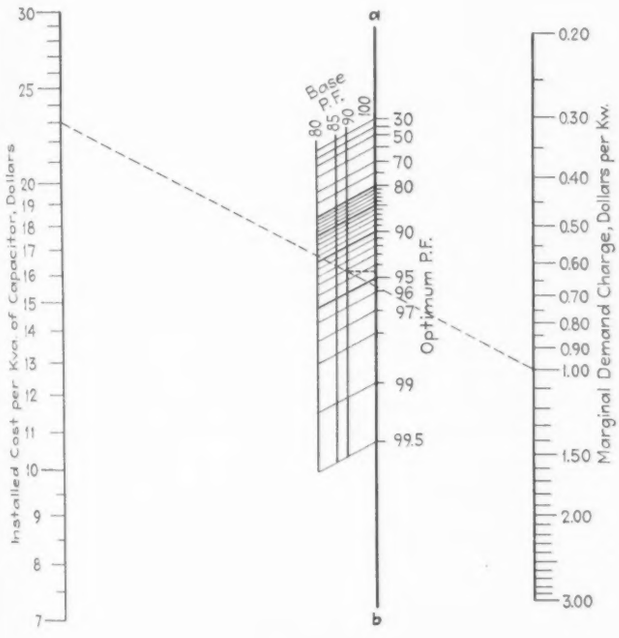
Select Capacitors to Meet Power-Factor Clauses

By A. A. BOLSTERLI
Engineer Products Protection Corporation, New Haven, Conn.

Capacitor rating should be chosen, is Mr. Bolsterli's stand, to balance the annual capacitor charges against the marginal kva. demand rate saving for the block in which the maximum demand falls. This will be more advantageous than merely getting maximum correction per capacitor dollar.

As a result of his plan higher power factors are obtainable at lower cost.

THE MOST economical amount of power-factor correction is usually determined by trial and error by assuming different sizes of capacitors, working out the economic balance for each, and selecting the size that affords the maximum savings at the least cost. Apart from the cost of the capacitors, which is largely a function of the power factor before and after correction, the power rate schedule is the prime consideration in all instances in which power is purchased by a customer under a power-factor biased rate.



Optimum power factor alignment chart

The chart represents the condition for maximum economy for an assumed annual operating cost of 15 per cent of the first cost ($p = 15$), which is ample for capacitors. The optimum power factor can be read directly for base power factors of 100, 90, 85 and 80 per cent.

For a base power factor of 100 per cent (straight kva. demand) the optimum power factor is read on the center scale a-b, whereas for the other base power factors the intersection point with the axis a-b is projected at a right angle onto the respective base power factor axis and the reading taken at the projection. For example, when the cost of capacitors is $23 per kva. and the marginal demand rate $1 per kw., the dotted line shows that the optimum power factor is 95.7 when base p.f. is 100 per cent (straight kva. demand charge) or 94.6 for base p.f. of 90 per cent, 94.3 for base p.f. 85 per cent and 93.4 for base p.f. 80 per cent.

For one of the most widely used rate forms, namely, the block Hopkinson demand rate with power-factor adjustment in the demand part, it is possible to obtain the most economical, or optimum, power factor by simple analysis, thereby eliminating the work entailed by the trial and error method. An alignment chart is presented which permits reading results in an instant.

The method developed refers specifically to that frequently used modification of the block Hopkinson demand rate in which adjustment for power factor is made by taking as the billing demand the product of the measured kilowatt demand into the ratio of the base power factor and the measured power factor. With "base power factor" is thereby meant the power factor stipulated for adjustment in the rate schedule. It is usually 80, 85, 90 or 100 per cent, the case of 100 per cent amounting to a straight kva. demand charge. A rate of this character obviously results in an increase or decrease in the demand charge, depending upon whether the measured power factor is below or above the base power factor. There exists no uniform practice as to what is to be taken as the "measured" power factor. A monthly average power factor determined from the readings of a reactive meter and the watt-hour meter is frequently used, because it entails the least extra expense in metering equipment. The opinion is held widely, however, that the power factor at the time of maximum demand represents a truer basis for adjustment and it is in fact increasingly used.

The relatively high cost of the corresponding meters has been a deterrent in the past, but progress is being made in reducing the expense. The following deductions hold strictly only when "measured" power factor means power factor at maximum demand. The influence on results of using the monthly average power factor is, however, discussed.

Capacitor cost balanced against marginal rate

Let D be the kilowatt demand, d the marginal monthly demand charge in dollars per kilowatt, i.e., the charge per kilowatt for the last block in a block demand rate, $\cos \varphi_1$, and $\cos \varphi_2$ the uncorrected and corrected "meas-

ured" power factor, f the base power factor. The monthly savings in the demand charge are then equal to

$$D\,d\,f\,(1/\cos\varphi_1 - 1/\cos\varphi_2)$$

If C (dollars per kva.) is the installed cost per kva. of capacitor and if we assume that the annual operating cost (interest, taxes, depreciation, losses, maintenance) is p per cent of the first cost, the monthly operating cost is equal to

$$C\,D\,p\,(\text{tg}\,\varphi_1 - \text{tg}\,\varphi_2)/1{,}200$$

The monthly net savings are the difference between the gross savings and the operating cost, and maximizing this difference for the corrected power factor, it is found that the net saving becomes a maximum when the condition $\sin\varphi = Cp/1{,}200d$ is satisfied $\sin\varphi$ being the reactive factor corresponding to the optimum power factor. The optimum power factor under the rate form considered is thus solely a function of the marginal demand charge (d), the installed cost (C) per kva. of the capacitor, and the percentage (p) representing annual operating cost.

It may happen that the billing demand after correction recedes into a preceding demand block for which the rate is accordingly higher. In this case the reading is taken for the higher marginal demand rate as well and the optimum power factor then lies between the two readings. It is not difficult to interpolate properly by considering the relative overlapping by the reduction in demand on the adjoining demand blocks.

It is well known that for a definite correction of power factor the rating of the requisite capacitor is smaller when calculation is based on a "monthly average" power factor than when based on power factor at maximum demand, this being due to the fact that the capacitor load is constant and correction therefore relatively the larger, the smaller the kilowatt load. Consequently the operating cost is less, entailing a shift of the optimum power factor toward higher values. It follows that when using the chart, by taking as the "measured" power factor monthly averages, the true optimum power factor is higher than the one read from the chart. A valuable point of reference is, however, obtained thereby in a case that inherently necessitates a step-by-step approach for still closer approximation.

The chart shows clearly that with present costs of capacitors and prevailing demand rates correction to a much higher power factor than commonly assumed is economical under the modified block Hopkinson rate form.

Tube Expansion Opens Annealing Circuit

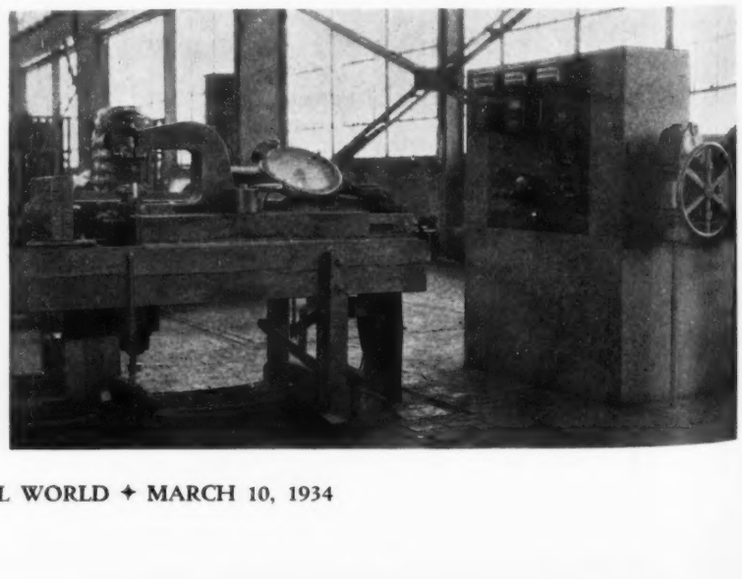
So simple that one wonders it was not done before. When a tube has been annealed electrically to the proper point expansion under the heating is sufficient to trip a relay.

By GEORGE E. WHITTAKER
Resident Electrical Engineer
Chase Copper & Brass Company, Cleveland

Relationship which exists between temperature changes and changes in length of tubes of copper, of brass and of alloys of these metals has made possible a simple machine for annealing them. The ends of the tube to be annealed are clamped between supports, one of which is fixed in position, the other free to move horizontally and register the amount of that movement on a dial switch. The tube supports constitute the low-voltage terminals of a 750-kva., 4,600-25/400-volt, single-phase, oil-insulated, self-cooled transformer, while the tube itself short circuits the winding of the transformer.

The 4,600-volt, high-voltage side of the transformer is equipped with two ratio adjusters, which are manually operated to provide annealing current values from 41 to 163 amp., obtainable in nine steps. On the 25/400-volt low-voltage side, with the four coils of the transformer connected in parallel, taps provide voltages of from 25 to 100 volts at 7,500 amp. With the coils connected in series-parallel the taps give from 50 to 200 volts at 3,750 amp.; with the coils connected in series the taps give from 100 to 400 volts at 1,875 amp. Solenoid-operated locks interlock these ratio adjusters with the manual starting control so that they cannot be changed unless the air-break contactor is open.

With the tube placed between the supporting clamps, the electrical circuit is closed through a switch, which first energizes solenoids on the clamps of the supports and closes them firmly on the tube, then closes a 4,600-volt air-break contactor that energizes the transformer. As the tube starts to heat it lengthens and pushes back the movable support. This in turn revolves an arm on the dial switch, which, as it reaches a predetermined setting, breaks the main power circuit through a relay. The tube, annealed, rolls out of the clamps.



Simplicity itself, this machine speeds annealing of brass and copper tubes by relating elongation and temperature rise in the metal

LETTERS TO THE EDITOR

Ten Cents per Outlet per Week for Tennessee's Unwired Homes

To the Editor of the ELECTRICAL WORLD:

In the Tennessee Valley, as elsewhere, there reside people of all degrees of wealth and of habits and of customs of living. There are—referring to the N.E.L.A. statistical department's Table VIII of April 1, 1930—in the states of Kentucky, Tennessee, Alabama, Mississippi and West Virginia 819,346 urban families, 74 per cent of whom live in houses served by electricity and 211,432 of whom do not. Of farm homes there are 2.13 per cent with and 1,151,834 without and of non-farm rural homes 28.5 per cent are wired and 435,640 are not.

In the state of Connecticut there also live people of various degrees of habits, and so on. They are not unlike those of the Tennessee Valley in their desire for the benefits of good lights and of good radio sets and of electrical household conveniences, but they differ from them in the average amount of wherewithal to pay for these benefits and for the necessary appliances. Connecticut records a few more urban homes wired than there are urban families, farm homes to the extent of 34.6 per cent have service, and the non-farm rural homes are 96 per cent wired. Furthermore, at least a fair portion of this high saturation was obtained in the early days by limited flat-rate lighting.

Unwired urban homes in the Tennessee Valley number 200,000. Rural homes unwired number about 400,000. If 34.6 per cent of the Connecticut farms take current it would not appear unreasonable that 15 per cent of the Tennessee Valley farms ought to be prospects, and 15 per cent of 1,151,834 is 170,000, making the grand total of prospective unwired homes in the valley 770,000.

Ten cents per outlet collected in cash as a flat rate each week by a collector-inspector-repairman-lamp salesman would mean from these homes a gross, for four outlets per home, of $16,000,000 a year, exclusive of lamp sales. It would seem to be a market worth trying for, and a market on which profit could be made—bearing in mind the type of people to be served, excluding from mind those services for which these people will not or are in no position to pay, and attending to all economies which are possible in furnishing service satisfactory to them in their conditions of life.

There would be a profit at 10 cents per outlet

Extreme usage would be the job of an inspector to stop, or the job of a fuse or of a current-limiting or a current-flashing device or of a circuit breaker per house to limit.

A house electrically lighted, in part at least, and a radio outlet for 40 cents a week is cheap, the wiring for a flat rate house is cheap, and a district meter instead of an individual meter is cheap. Possibly even more business and a greater profit could be had at 8 cents per outlet.

Vacuum cleaners and toasters and cook stoves and water heaters and flatirons and all the other accessories may be desired to a degree, efforts in selling them are not to be deprecated at all, but they cannot be sold in an unwired home and they won't be bought by a family which has just taken the first step and commenced using electricity for lights and for radio. Such families are poor, their incomes are low, their habits tend strongly to stay fixed. They already *have* fuel ranges and brooms, but their lighting is poor and their radios are usually of poor quality.

The problem is one of expansion—expansion into areas of a lower grade than those usually considered profitable in the supply of electricity. It is competitive marketing, just as any business expansion, up or down, is competitive—not necessarily a matter of competition with similar business, but of competition with all other businesses for a portion of the well-known consumer's dollar.

The objection is to be met that existing metered customers would demand flat-rate service. They will not, in any appreciable number. They are accustomed to the use of accessories and to reasonably adequate illumination. Also, low-wage families are congregated in more or less definite areas, which are quite likely to remain low-wage, consequently flat-rate limited lighting had best not be treated to a promotional rate; it is not likely to change to metered service for some years. Furthermore, wiring within homes and distribution to the areas in question should not carry undue expense for provision for future high-grade service. For a particular home of low degree the service will most likely remain of low degree. Metered lighting is accompanied by other changes, by a new house, in districts not compact. In congested districts the transition to better lighting may mean, and I think is likely to mean, the erection of multiple dwellings at points quite unpredictable.

Distribution standards also scaled down

There is in this suggestion no hint that the job of the engineer is ever to be completed. Areas grow unevenly in prosperity, and over a period of years original plans must be abandoned, existing plant changed, some of it scrapped perhaps, most of it improved, let us trust. There is no surcease from detailed labor yet to be found, which may, after all, be just as well.

But in the Tennessee Valley, with its small percentage of electrical usage, and with a supply of low-cost energy which the T.V.A. would prefer to see expended among the low-wage inhabitants, there, I would submit, studies should be made of practices which depart downward from those usual in furnishing current at the present time to other and richer areas.

Whether a service is low in grade or high in grade depends upon the point of view. To a utility company flat-rate limited lighting with all possible frills eliminated, is low-grade service. There is no denying it. But it is the customer's point of view which is the one to take. He progresses from kerosene or from fish-tail gas to electricity. His lighting grades upward rapidly. He advances in civilization, and if he spends a greater proportion of his dollar for light than he did formerly, and is obliged therefore to economize on something else, we may be very sure that he is in some degree, and on the average, better off—a better individual—a more valuable man to the community.

W. A. RHODES.

New York City.

NEWS OF THE WEEK

Insull Ordered from Greece; Action Rests with Doctors

Seeking to stave off his departure from Greece after being ordered out of the country on a 48-hour time limit on Monday of this week by Minister of the Interior John Metaxas, Samuel Insull secured a 24-hour extension of stay to undergo another physical examination. The deposed utilities magnate has denied himself to all callers and was reported to be confined to his bed. Cable dispatches state that Minister Metaxas requested the United States legation in Athens to designate a physician to be present at the latest examination, which was to be conducted by Doctors Bensis and Liveratos, the Greek physicians who have twice before found Mr. Insull fit to travel. The legation declined to accede on the grounds that the request had not been made through the regular foreign office channels and that the American representatives regard the problem as one solely for the Greek government.

Bureau of Standards Code Cannot Be Legal Evidence

In a recent Circuit Court of Appeals decision in an action against an electric power company (Mississippi Power & Light Company vs. Whitescarver et al.; C. C. A. 5, No. 6790, Feb. 2, 1934; Sibley, C. J.) for death alleged to have been caused by the negligence of the company in maintaining its 13-kv. power wires at an insufficient height, the court excluded as evidence the National Electrical Safety Code issued in 1926 by the Bureau of Standards, showing minimum clearances of wires above ground or rails for electrical construction.

The court held that the code represents merely the opinion of the compilers; that it recognizes many conflicting views on practice, and many changes touching line construction with prospective further growth and development. Books in such a field are like medical works rather than almanacs, mathematical tables, approved histories, census compilations and weather reports which are admissible in evidence, the opinion declared. They contain merely the expert opinions of the authors, developed not under oath or subject to cross-examination, without opportunity to qualify or explain them, and without certainty that the author at the time of the trial adheres to the opinions expressed when the book was written.

T. N. McCarter Sees New Public Attitude

"If the present policy of the federal government in offering to supply money upon the easiest terms to municipal competitive undertakings in localities now served adequately and under strict regulation is continued the utilities will be compelled to furnish the means, in part at least, for their own destruction," declared Thomas N. McCarter, president Public Service Corporation of New Jersey, in his annual report to stockholders, issued this week. "The attitude of the federal government is difficult to understand," he continued, "and I do not believe that any such policy will in the long run commend itself to the American people."

Prosperity penalized

Commenting upon the governmental problems of operating utilities during the past year, Mr. McCarter said:

"The year that has passed has been full of difficulties for those who are engaged in the actual operation of large public utilities. The depression and the improper management of certain holding companies have combined to create an unfair impression in the public mind as to all utilities. The resultant agitation has taken various different forms, but has mainly been directed at the light and power industry because in the past it has been reasonably prosperous. An impression has been created that all such utilities should share in the depression by a wholesale reduction of rates, no matter what the effect thereof would be upon their economic structure or upon their ability adequately to serve the public in the future.

"Such a doctrine negatives the law of the land that at all times such companies under proper regulation are entitled to earn a reasonable return upon the fair value of the property devoted to the public use. It entirely disregards the fact that this is all that may be earned by such companies in the most prosperous of times. It ignores the frequent reduction in rates that have been made in recent years, many of them entirely voluntary. It pays no attention to the vast increase in taxes which have been imposed on these companies, some of them of entirely special character. It is unmindful of the increased cost of operation to which these companies have been subjected by the increase of wages, the lessening of the hours of work and the greater cost of commodities. It entirely overlooks the fact that the monthly bill of the average domestic consumer is approximately three dollars, and were these radical notions to prevail all that could be expected to be saved to the average consumer would be a small amount per month, which, meaning little to such consumer for the service rendered, would, taken in the aggregate, spell ruin for the industry."

No St. Paul City Plant

Proposal for the issuance of $10,230,000 in bonds to finance the construction of a municipal power plant at St. Paul, Minn., was defeated decisively this week. The vote cast in 210 of the city's 237 precincts was 48,851 against the proposal and 31,010 in its favor.

New Rules to Speed Up Ohio Rate Cases

Revision of its rules of evidence to speed rate hearings were adopted last week by the Ohio Public Utilities Commission. The rules drafted by Commissioner Frank W. Geiger, which will save months of time in rate hearings and save thousands of dollars, are a revision of his original plan and govern the presentation of expert testimony and new time limits for the preparation of appeals. The commission can submit evidence of its own engineers on the same basis as evidence of other experts and testimony by experts will be submitted to the commission in writing. Cross-examination of witnesses may be

conducted before the commission, before attorney examiners or referees, or in writing if the parties to the suit permit. Testimony in writing will greatly shorten the time to get such information and eliminate repetition of detail.

An inventory rule has been adopted so that if an appeal is filed from a municipal ordinance the utility must give a complete inventory to the city in 90 days; within 30 days the city must indicate what points of the inventory it will accept and the points of difference; the case must be ready for trial in six months after appeal is filed, and the commission reserves the right to end any rate case for lack of diligence in preparation by either party.

Municipal Utilities Object to Commission Regulation

Following a conference with the respective city attorneys, Superior Judge E. E. Pomeroy of Atlanta announced this week that La Grange, Newman, West Point and Marietta will join the city of Albany in injunction proceedings to prevent the Georgia Public Service Commission from regulating electric power rates in communities having municipally owned power plants.

The court has temporarily restrained the commission on petition of the city of Albany until a hearing on March 22. It is contended in the Albany petition that the Public Service Commission has no regulatory power over municipally owned plants and that such power is vested solely in the respective city councils. Petitions of intervention in behalf of these additional cities and still others similarly situated were expected to be filed this week (see page 383).

Alabama Utility Denies Commission Jurisdiction

Denial of the right of the Alabama Public Service Commission to investigate the disposition of $3,200,000 reported profits arising from the sale of the Birmingham Electric Company's gas utility in April, 1929, was made last week by the electric company and the controlling National Power & Light Company, in a plea filed in Montgomery.

The commission had ordered the National Power & Light Company to restore to the Birmingham company's capital account the profits appropriated at the time of the sale (ELECTRICAL WORLD, February 24, page 308). A suit also has been filed in the Chancery Court in Birmingham to force the holding company to replace the funds, with interest, appropriated in the sale of the gas utility (ELECTRICAL WORLD, March 3, page 346).

Piedmont Utilities Recover from Severe Ice Storm

Devastation covers 5,000 square miles. Service impaired for days, but transmission lines resist sleet and gales. Rapid recovery due to hard work by operating organizations.

PUBLIC utility service in an area from 40 to 50 miles wide and nearly 100 miles long was completely demoralized by an ice storm of record-breaking duration and severity that began the night of February 23 and lasted more than 36 hours in the most highly industrialized section of North Carolina. Centering at the important tobacco and textile city of Winston-Salem, the damage extended in all directions, with Greensboro, High Point, Salisbury and a score of other smaller places hard hit.

Repair forces concentrated

Wire failures began by noon on the first day. Before the following morning practically all wire service in the area was interrupted. Winston-Salem and Greensboro were completely without electric service for more than 24 hours. When the local headquarters of the Duke Power Company in those cities began to call for help the first day line crews were rushed there from all over the Duke system. Before that night hundreds of men were at work in an effort to maintain and to restore service. By noon on the second day service had been provided for hospitals, city water works and other vital agencies. But it was the end of the week before even 85 per cent of the consumers in Winston-Salem had been reconnected. By that time conditions in the other cities had been patched up also to the extent that most industries and domestic users were being served.

Heavy construction pays dividends

One feature of the disaster of special help was the fact that the steel tower transmission lines of the Duke Power Company suffered comparatively little. That company has always built such lines of exceptional strength, a policy that stood in good stead in this most unheralded and unprecedented experience.

Distribution lines and connections with consumers' premises suffered almost without exception. This was not surprising in view of the fact that thousands of trees in the damaged area were largely stripped of their branches and smaller limbs, and a good many trees fell entirely. Wire communication lines also were largely wrecked, one district reporting more than 1,200 poles broken or down, with many miles of wire a hopeless tangle.

Carolina Power & Light Company serves three of the smaller cities on the edge of the devasted area. Its forces were able to began restoration of service by the second morning after the storm began and had practically 100 per cent of its lines working by noon that day.

Winter lays down barrage on North Carolina front

Coming Meetings

Association of Iron and Steel Electrical Engineers—Youngstown, Ohio, April 12. J. L. Kelly, Empire Building, Pittsburgh.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 19-20. N. R. Beagle, 101 W. High St., Jefferson City, Mo.

Electrochemical Society — Asheville, N. C., April 26-28. Colin G. Fink, Columbia University, New York.

National Fire Protection Association—Atlantic City, N. J., May 14-18. A. R. Small, 109 Leonard St., New York.

American Institute of Electrical Engineers—Northeastern District meeting, Worcester, Mass., May 16-18. Summer Convention, Hot Springs, Va., June 25-29. H. H. Henline, 33 W. 39th St., New York.

Edison Electric Institute—Atlantic City, N. J., June 4-7. B. F. Weadock, 420 Lexington Ave., New York.

Refutes Political Attacks

Vigorously denying that Washington utilities dominate the state regulating commission and defending public welfare and chamber of commerce support as legitimate operating expenses, President Frank T. Post of the Washington Water Power Company in a recent address assailed Senator Bone and Governor Martin's contentions that power companies in the state prevent just regulation by obstructive tactics. He declared that liberal appropriations have been made for the commission since 1911 and the board has been given more than a million dollars in the past three years to expend in its impartial tasks. Public service companies now pay 0.1 per cent of their gross revenues for this purpose. The Governor, said Mr. Post, can appoint and discharge commissioners if they are unsatisfactory. Welfare and business development organizations should be aided out of operating expense money and not from net earnings available for dividends, the speaker asserted.

Britons Using More Energy

British central-station production gained 14.8 per cent in January over the same month a year ago, the total output for authorized "undertakers" being 1,536,000,000 kw.-hr., or the same total as in December, 1933. Allowing for one more working day in January, 1934, the adjusted increase was 10.5 per cent, or about the increase 1933 showed over the figures of 1932.

Another T.V.A. Contract

Agreement was reached this week between the Tennessee Valley Authority and the city of Florence, Ala., on terms of a contract to supply that municipality with electric energy from the Wilson Dam hydro-electric plant. Florence was the third city to agree on terms with the authority. Tupelo, Miss., was the first and is now receiving energy, Knoxville, Tenn., being the second. The contract is similar to that drawn for Knoxville, and officials said it would mean substantial savings for all classes of consumers, residential, commercial and industrial.

Missouri Valley Men Tackle Utility Operating Problems

How to keep the system running when revenues decrease and arbitrarily imposed costs increase is the present concern of the electric utility engineer.

CAUGHT between the millstones of necessity for continued satisfactory system operation and of reduced revenues plus increased costs, the engineer diligently seeks ways and means to economy in the details of his job. This was the impression to be taken from the engineering conference of the Missouri Valley Electric Association at Kansas City, Mo., March 1 and 2. Of the 91 talks, papers and discussion topics listed on the program to engage the attention of the 192 engineers registered at the meeting, all were of practically equal importance. The dimes saved by attention to the "operation of evaporators, heaters and deaerators to improve station heat balance" are no more valuable coins than those conserved by keeping an eye on "meter jewels and bearings" or on the "uses and limitations of mechanical splices and taps."

Commercial-minded engineers

Yet there was one extremely significant phenomenon of this particular engineering meeting that marked it as differing from most of its kind. This was the evidence it presented that the utility system engineer is at last beginning to concern himself with commercial matters. This was shown in three ways: (1) By the inclusion of a meeting of power salesmen in the engineering program; (2) by a joint session of power salesmen with the power systems engineering committee, and (3) by a combined discussion of range wiring by the apparatus and meter committees. Since in the national electric utility association the meter committee is now merely a division of the apparatus committee, it was to be expected perhaps that the meter men should exhibit, as they did in this particular session, a certain human satisfaction at the opportunity to saddle the troublesome problem of range wiring methods and costs upon the larger group. Two subjects of common interest were discussed in the joint sessions of the power sales and power system engineering committees. These were Diesel engine competition and combined operations of utility and industrial plants. The general opinion after these sessions appeared to be that the success or failure of the power salesman in meeting Diesel competition and in working out the economics of interconnection with industrials must have a profound effect on system development.

Economy vs. reliability

In the overhead systems meeting a question was raised for discussion which has been dodged quite consistently in recent years, but which will have to be faced squarely sooner or later. Which is the more important in the operation of transmission and distribution systems, extreme economy of maintenance or service reliability? The answer necessarily involves a definition of reliable service, which is one thing to the farmer, another to the residence customer, a third to the city store and possibly several different things to the industrial customer. Reducing maintenance cost by cutting down maintenance can be carried quickly to its limit, but conditions are not so happy when the sins of past omissions demand their toll. The committee found no answer to the question other than that of doing the best job possible with available facilities and money.

Turning from Diesel competition to a more cheerful subject, the power sales committee gave its attention to the present upturn of business and considered the many factories and other business establishments that have been watching conditions and waiting for signs to point the opportune time to go ahead and that are now about ready for long-postponed replacements, improvements and expansions in which electricity must play a large part. In power plant operation, the prime movers committee was occupied with improvements in heat balance by use of heaters, evaporators and deaerators, with the problems of natural gas firing and with the relocation of steam lanes in a surface condenser to achieve improved operation. Compensating metering, current diversion and new sequence metering engaged the attention of the meter committee when blood pressures had subsided to normal after the range wiring discussion and the apparatus committee had gone peaceably back to its consideration of equipment fires, relays, regulators and other topics.

Lamoka Hydro-Gas Plant Partially Dismantled

Removal of the gas engines from the Lamoka Power Corporation's principal storage plant on Lake Keuka, Penn Yan, N. Y., by their owners, the Worthington Pump Company and the Ingersoll Rand Company, marks a climax of a hydro-electric enterprise started in 1922, and now doomed to failure for base load by the drop in gas pressure of the wells drilled in 1931-32. The engines were used to pump water to Lake Lamoka, from which the drop to the hydro plant on Lake Keuka is 400 ft. The plant was used to meet peak loads of the Associated Gas & Electric System before gas was found and for base load 1932-33 while the gas held out. It will again be used for peak loads except at times of high water; it operates at present 16 hours a day.

The plant was designed originally as a hydro-electric plant, using water from Lakes Lamoka and Waneta, to be brought by canal and penstock to the plant on Lake Keuka. Only one of three stages of the hydro plant was ever built and this was completed in 1929 (ELECTRICAL WORLD, March 23, 1929, page 609). With the discovery of natural gas the company saw the possibility of eliminating the large seasonal water variation and drilled what proved to be the largest flow wells in New York State at the time. By January 1, 1933, it was expected to have 9,600 hp. of gas engines and 12,600 hp. of hydro-generators in use (ELECTRICAL WORLD, March 12, 1932, page 474).

White River Plan Drafted

Development of the White River Valley in Arkansas and Missouri through a program similar to that undertaken in the Tennessee Valley has been proposed in a bill drafted recently by Representative Miller of Arkansas. "Enough electrical energy could be produced from the streams of the valley," he said, "to supply all of Arkansas, the south half of Missouri and the southeastern part of Kansas, the eastern half of Oklahoma and the northern parts of Louisiana and Texas." The bill provides also for improving navigation facilities on the river, reforestataion and other use of marginal lands, as well as industrial and agricultural development.

MORE LIGHT PER DOLLAR

Halbran

With the installation of sodium lamps at West 231st Street and Riverdale Avenue, New York City, the long reign of the filament type lamp appears to be threatened in metropolitan highway service. Aside from approximately doubling the efficiency in lumens per watt, this type of lamp marks a striking gain in visual acuity and uniformity of illumination which contributes to accident prevention as well as comfortable seeing. The lamps shown were designed by Dr. H. J. Spanner and the contrast between the older illumination in the background and the new installation is notable. Further installations are about to be made at Lexington Avenue and 30th Street, the Harlem River Speedway and other places. It is said that Mayor LaGuardia's office is contemplating the use of a trial installation of filamentless lamps. An installation of sodium lamps on the General Electric Building, New York, was featured in the ELECTRICAL WORLD, February 3, 1934, page 200.

MERRY-GO-ROUND

Early appearance on the statute books of the Johnson bill to limit jurisdiction of federal courts in utility cases is expected. It is understood that a majority of the members of the judiciary committee of the House of Representatives is prepared to vote for a favorable report. This is in spite of evidence brought before the committee at public hearings to the effect that federal courts have a better record than have state courts for expeditious handling of dockets.

While the interstate commerce committee of the House pigeonholed Representative Rankin's bill authorizing the necessary funds for the conduct of an investigation throughout the country of rates charged for electrical energy, so much pressure is being brought in behalf of the Norris bill, which has passed the Senate, that some believe the committee will reopen the question and may report favorably on the Senate bill.

The electric light and power code still is in deadlock. There is reason to believe that the industry is being told at the NRA that unless it agrees promptly with NRA officials the policy of shorter hours may result in a 36-hour provision, instead of a 40-hour week, which has been offered.

NRA officials have given indication of being lukewarm in their attitude toward the proposed compensatory tax on natural gas. As a result the bill drafted by the National Coal Association, intended to offset the disadvantage suffered by coal, has not been brought forward. NRA economists are studying the situation.

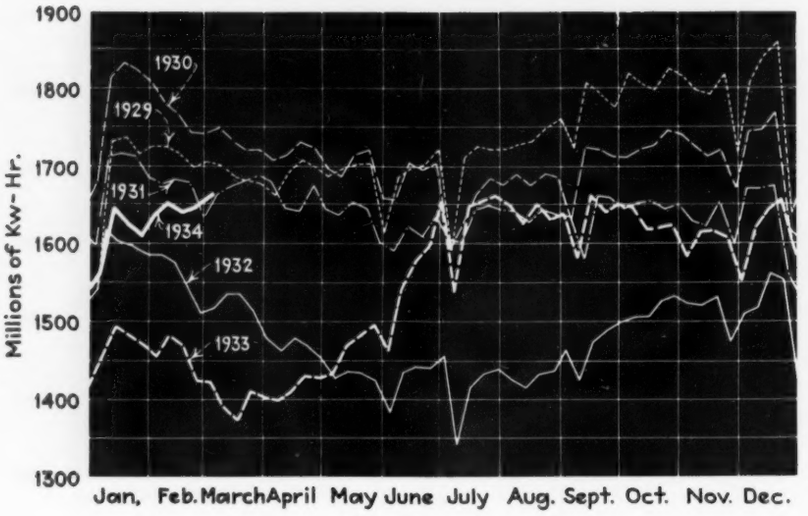
A good case is being made at the hearings on the Shannon bill for definite and systematic accounting under which the costs of publicly owned activities can be compared readily with those of similar private enterprses.

PAUL WOOTON,
Washington Correspondent.

Suit Dismissal Asked

Dismissal of the amended bills of complaint recently filed by Tessie Berwick and others against Associated Gas & Electric Corporation and Associated Gas & Electric Securities Company, Inc., both Delaware corporations, and Associated Gas & Electric Company, a New York corporation (ELECTRICAL WORLD, February 10, page 241), has been asked in a demurrer filed in Chancery Court in Wilmington by counsel for the two Delaware corporations. The demurrer avers that the bill of complaint, which charged that the New York corporation unlawfully transferred the controlling stock of Associated system subsidiaries to the Delaware corporation, involves consideration of the internal management and affairs of a corporation foreign to Delaware jurisdiction.

Week's Output Sets 1934 High



Continuing on its recent rising trend, which is unusual at this time of the year, the output of central electric light and power plants during the week ended March 3 reached the highest figure thus far recorded in 1934. It amounted to 1,658,040,000 kw.-hr., according to the Edison Electric Institute. It surpassed the corresponding production of the preceding year by 16.5 per cent and of two years ago by 9.5 per cent. Both are new records for the depression period. It broke through 1931 and more than matched the best weeks of last summer.

The abnormally severe weather prevailing over large areas can account for only a portion of the increase; there has been consistent progress for several weeks. In the Central industrial area the gain over 1933 again approached 25 per cent; in New England and the Middle Atlantic states it exceeded 15 per cent; in the South it rose from 4 to 12 per cent.

Weekly Output, Millions of Kw.-Hr.

1934		1933		1932	
Mar. 3	1,658	Mar. 4	1,423	Mar. 5	1,520
Feb. 24	1,646	Feb. 25	1,426	Feb. 27	1,512
Feb. 17	1,641	Feb. 18	1,470	Feb. 20	1,545
Feb. 10	1,652	Feb. 11	1,483	Feb. 13	1,579
Feb. 3	1,636	Feb. 4	1,455	Feb. 6	1,589

Per Cent Change from Previous Year

Region	Week ended Mar. 3	Feb. 24	Feb. 17
New England	+15.7	+14.2	+13.2
Middle Atlantic	+15.3	+14.4	+12.1
Central Industrial	+24.6	+24.7	+15.4
West Central	+10.0	+ 7.5	+ 3.1
Southern States	+11.9	+ 4.1	+ 7.0
Rocky Mountain	+18.2	+16.3	+12.0
Pacific Coast	+ 7.7	+12.5	+ 8.9
United States	+16.5	+15.5	+11.6

January Output Up 10 per Cent

More energy, by 10 per cent, was generated during January in public utility plants this year than last, and more also than two years ago, though by a smaller margin. The total output, according to the U. S. Geological Survey, was 7,614,000,000 kw.-hr., of which 37 per cent came from water power. A year ago it was 6,932,000,000 kw.-hr., 43 per cent from water power. The average daily output during the month was 2 per cent larger than in December; the normal change from December to January is less than 1 per cent. Output from water power was 1 per cent greater than a year ago, though it constituted a smaller fraction of the increased total.

In November and December the gain compared with the preceding year was only 4 per cent. The changes in January, therefore, marked an auspicious beginning for 1934.

Unusually high ratios appear in New England and the East Central Division; the latter, both North and South, generated 18 per cent more than a year ago. There was a sharp increase from December also in the Middle Atlantic region. These changes occurred in the manufacturing areas. The Southwest and Mountain divisions, reflecting conditions in oil production and the mining of metals, shared in the gain.

Regional comparisons, showing percentage gains with reference to the preceding year, are given in the table for the three latest months.

Division	Nov.	Dec.	Jan.
United States	+ 4	+ 4	+10
New England	+ 7	+10	+16
Middle Atlantic	+ 6	+ 2	+ 9
East North Central	+ 8	+10	+18
West North Central	+ 3	— 1	— 6
South Atlantic	— 9	+ 1	+ 4
East South Central	— 5	— 6	+18
West South Central	+ 2	+ 3	+12
Mountain	+25	+18	+20
Pacific	+ 3	+ 4	+ 4

Yearly Output Gains; First Time Since 1929

Gaining over the preceding year for the first time since 1929, the production of electricity for public use during 1933 exceeded that of 1932 by 2½ per cent, the total amount being 85,164,000,000 kw.-hr., according to preliminary figures announced by the United States Geological Survey. The year-to-year changes since 1928 were, first, an increase of 11 per cent in 1929, then successive decreases of 1½, 4½ and 9½ per cent. The change from a large annual decrease to an increase indicates a marked change in the demand in 1933, the Survey report states. The increase started in May and continued to the end of the year. Tables giving the annual production for earlier years were published in the ELECTRICAL WORLD of January 6, 1934, on page 20.

Production by the use of water power was about 1 per cent larger than in the previous year and was 41 per cent of the total, as in 1932. These figures indicate that water-power plants are still maintaining their position in the production of electricity for public use.

The information in the accompanying table is based on the figures of production of electricity previously published in the monthly power reports issued by the Geological Survey. The output of central stations, both commercial and municipal, electric railway plants, plants operated by steam railroads generating electricity for traction, and Bureau of Reclamation plants, and that part of the output of manufacturing plants which is sold are included in the monthly report. The output of central stations and electric railway plants represents about 98 per cent of the total.

Production of Electricity for Public Use in 1933*

(United States Geological Survey)

Region	Output (Thousands of Kw.-Hr.) Total	Change from 1932	From Water Power	Change	From Fuel	Change
United States	85,164,219	+2.4	34,522,806	+ 1.2	50,641,413	+ 3.2
New England	6,054,474	+5.8	2,652,627	— 7.0	3,401,847	+18.4
Middle Atlantic	22,972,284	+1.2	6,884,346	+ 4.7	16,087,938	— 0.2
East North Central	18,847,402	+3.7	2,095,434	— 5.0	16,751,968	+ 5.0
West North Central	5,481,470	—1.0	1,547,696	— 3.6	3,933,774	+ 0.1
South Atlantic	9,998,361	+6.4	5,941,752	+ 6.8	4,056,609	+ 5.7
East South Central	3,530,356	—0.7	2,966,907	— 0.4	563,449	— 2.4
West South Central	4,229,063	+2.0	179,050	+15.2	4,050,013	+ 1.4
Mountain	2,773,925	+9.6	2,212,711	+15.0	561,214	— 7.3
Pacific	11,376,884	—0.2	10,142,283	— 9.3	1,234,601	+ 5.8

*Preliminary, subject to revision.

As to Rates——

• Georgia Public Service Commission has ordered an investigation of rates and charges made by municipalities in the state which buy electric power and resell it to citizens of their communities. This is believed to be the first time that a state public service commission has attempted an investigation of this nature. April 2 has been set as the date for a hearing as to why the rates charged by these municipalities to their citizens should not be reduced.

• Kansas Power Company has announced a cut of from 4 to 3 cents in the lower step of its small electric power rates which will save consumers approximately $3,500 a year. The Kansas Power Company is an affiliate of the Kansas Power & Light and the United Power & Light corporations, which recently announced substantial reductions in residence and commercial lighting for more than 300 towns.

Repercussions in Maryland

• Eastern Shore Public Service Company's electric rates will be investigated in the near future as the result of charges that rates were much higher in the territory served by the company than in Baltimore. It was pointed out that whereas it would cost $4.50 at Tupelo, Miss., and $9 in Baltimore for 251 kw., the charge at Salisbury for the same amount of current would be $23.57. Harold E. West, chairman of the Maryland Public Service Commission, explained that consumers of electric power on the Eastern Shore cannot expect to get their current as cheaply as the citizens of Tupelo or Baltimore. He said that at Tupelo the power was generated at Muscle Shoals where energy is sold at a low rate, with no regard to the amount of money invested in setting up the plant to produce the power. In Baltimore the rate can be lower than on the Eastern Shore, Mr. West said, because the city has a larger number of consumers in a relatively small territory, thereby cutting cost of maintaining lines over long distances. The investigation into the rates charged will take into consideration all phases of the question. The commission will attempt to learn what is a fair return to the company for its investment on the Eastern Shore.

• Utah Power & Light Company's rate investigation has continued, with S. R. Inch, president of the Electric Bond & Share Company, promising the state Public Utilities Commission full cooperation in laying before it any facts relevant to the relations of Bond & Share with the local power company and "necessary for your thorough and proper consideration of all issues raised with respect thereto." The commission decided to withhold any ruling for the present on the petition to make Electric Bond & Share Company a party to the proceedings.

• Westchester Lighting Company's reports made to the New York Public Service Commission do not justify a decrease at present in its rates, officials of Scarsdale were informed in reply to their petition for a reduction. The commission said that it had no funds to start an investigation of the matter.

• Northern Indiana Public Service Company has reduced its rates in the city of Hammond approximately 5 per cent. Many similar reductions were made in wholesale rates paid by North Webster for power bought from this utility. The town of Porter also had a new contract approved for approximately the same percentage of reduction. Rates in the Angola district have been reduced about 6 per cent.

• Portland, Ind., municipal light department has reduced its rates for domestic consumers approximately 10 per cent and industrial rates approximately 8 per cent. It is the fourth time in three years that the municipal plant has made voluntary reductions in electric rates.

• Conowingo Power Company's rates, services, plant and business have been ordered investigated by the Maryland Public Service Commission. This subsidiary distributing company of the Philadelphia Electric Power Company, which operates the well-known Conowingo hydro-electric plant, is one of the few that has not been valued by the commission in the last few years. Several months ago the rates charged by a number of companies in the state were reduced as a result of conferences held between officials of the company and members of the Public Service Commission. It was stated, however, that negotiations with the Conowingo company failed to reach an agreement.

Municipal Items

NEWCASTLE, IND.—This city has lost in the injunction suit brought by the Public Service Company of Indiana seeking to prevent the municipality from engaging in the electric utility business. A special judge in Circuit Court has overruled the city's demurrer to the complaint of the company. The city contended that the doctrine of quasi estoppel had precluded relief to the Public Service company through an injunction. The contract signed in 1928, under which the city purchases current for its street-lighting system, was cited as the reason for this quasi estoppel. Under the contract terms it was provided that neither party "shall waive any right that either may have to manufacture and sell electric current for distribution and consumption." It was contended that acquiescence in this contract by the utility created the estoppel and precluded the plaintiff from maintaining an injunction action.

WYANDOTTE, MICH.—On March 3 this city formally placed its new public-owned electric power plant in service. The station, costing $540,000, is said to have been paid for out of earnings of the city system. For the sixth time in eight years the city has cut its rates to domestic consumers, voting a 10 per cent rebate, in addition to the similar rebate already in force, for prompt payment of bills.

CREWE, VA.—Petition bearing the names of certain citizens who are opposed to the application to the Public Works Administration for a loan and grant of $126,000 for the construction of a municipal power plant has been filed at the offices of the P.W.A. state advisory board. The petition states that the city, which now is supplied with power by the Virginia Public Service Company, has a 30-year franchise with this company, granted in 1925. A reassessment which is now contemplated may reduce the assessed value of the real estate so that the present bonded indebtedness may equal the constitutional limit of 18 per cent of the assessed value of the real estate, the petition alleges. That privately operated plants are more highly organized and are able to operate much more efficiently than municipally owned plants, is the conviction of the petitioners.

FORT WORTH, TEX.—Municipal Ownership League has announced that if it finds there is no hope of obtaining a loan of $2,228,000 from the P.W.A. to construct a municipal electric light and power plant it will urge the City Council to call an election to vote on the proposition of issuing that amount of bonds for the purpose. The city's application for the proposed loan will not be received at the P.W.A. headquarters at this time, according to R. A. Thompson, state P.W.A. engineer. While Council voted to make application for the funds pending investigation of petitions calling for an election upon the question, Mr. Thompson explained that the time for filing applications had expired.

DYERSVILLE, IOWA.—Survey has been started to determine the feasibility of constructing a municipal light and power plant, under authorization of the city. The work is to be completed some time this month.

DES MOINES, IOWA.—Voters have petitioned City Council to submit a question on the establishment of a municipal light and power plant at the regular city election to be held on March 26.

FINANCIAL · · · BUSINESS

President Roosevelt Urges Communications Control

Creation of a federal communications commission to control transmission by telephone, telegraph, wireless and cable was urged upon Congress by President Roosevelt in a special message read in both branches of congress last week. The President asked that Congress vest in such a new federal body the powers now exercised by the Radio Commission over wireless communication and by the Interstate Commerce Commission over telephones, telegraphs and cables. Expressing the belief that the relationship of government to certain utilities should be classified into three groups, transportation, power and communication, with appropriate bodies to deal with each, he pointed out that the I.C.C. is now concerned with transportation and the Federal Power Commission with power, but that there exists no "single government agency charged with broad authority" regarding communications.

The President's special message followed the recent recommendations of his special interdepartmental committee on communication.

G. E. Dividend Raised

Stockholders of the General Electric Company will receive a quarterly dividend of 15 cents per common share at the next distribution, instead of 10 cents per quarter, by vote of the directors at last week's annual meeting. The smaller rate has been paid since the first quarter of 1932, when 25 cents per share was disbursed. The regular dividend of 15 cents a share on the special stock was also declared. Preliminary figures for 1933 show a consolidated net income of $13,429,739, equal after dividends on the special stock to 38 cents a share on the common, against $14,404,110 or 41 cents, in 1932. The 1933 dividends were 40 cents on common against 55 in 1932.

Sales billed in the fourth quarter of 1933 were $39,211,122, against $34,-112,816 in the 1932 like period. These were the largest for any three months since the second quarter of 1932. Total sales billed in 1933 were $136,637,268, against $147,162,291 for 1932. Orders received in 1933 exceeded shipments for the first time since 1929, leaving a greater amount of unfilled orders on January 1, 1934, than a year ago. January and February orders ran 49 per cent above the same months last year.

HOLIDAY

Scarcely reflecting the Washington's Birthday holiday hiatus at all, business activity barometers continue to point to clearer skies. Demonstrating contra-seasonal gains, electrical energy production has set a new 1934 high and stands 16.5 per cent over last year. Steel output is currently the highest since last September and virtually double that of a year ago. Carloadings in the holiday week dropped but 4.3 per cent and are 24 per cent above a year ago. Lumber production down slightly. Automobile production off somewhat, but March schedules call for 25 per cent gain over February.

Prices show little strengthening tendency, though appeals for a 30-hour week would indicate the necessity of such a trend if carried to consummation.

The establishment of municipal plants is being urgently encouraged and financed by money from the Federal Treasury on easy terms, in spite of the excess of power facilities existing throughout the country, owing to the lack of customary expansion in demand during recent years. Whatever losses the government may cause or incur by these transactions must be borne by the investing and taxpaying public, but the municipalities, exempt from federal taxes, are invited and encouraged to avoid and transfer to the backs of others not only these losses but also their inhabitants' equitable share of the total federal tax burden. It is difficult to see any justice or equity in such action.

THOMAS K. CUMMINS,
Vice-President and Treasurer
Edison Electric Illuminating Company of Boston

Discussing the lack of public understanding of the electric utilities' problems in the company's magazine, "Edison Life," Mr. Cummins takes exception to the unsupported statement freqently made that while costs of all elements entering into living expenses have declined drastically during recent years, rates for electric service show little or no reduction.

Federal Trade Adds to Salary Lists

FURTHER disclosures of electrical salaries and/or bonuses in excess of $50,000 have been set forth for popular delectation by the Federal Trade Commission. Both utility and manufacturing executive names appear and may be added to those published in last week's issue, page 345. Maximum and latest totals of salary and bonus paid each are listed with their years:

General Cable Corporation paid W. Robbins $57,248 in 1929 and $37,120 in 1932, and H. T. Dyett $55,636 in 1930 and $27,870 in 1932. Kelvinator Corporation paid B. A. McDonald $50,000 in 1928 and $19,375 in 1929 (salaries only) and C. W. Mason $109,780 in 1932 and salary only of $50,000 in 1933. Westinghouse Electric & Manufacturing Company, in addition to A. W. Robertson, already mentioned, paid F. A. Merrick $87,870 in 1930, $52,290 in 1932 and salary alone of $54,886 in 1933; L. A. Osborne $67,751 in 1930, $34,615 in 1932 and salary only of $14,636 in 1933 in addition to part of salary at the annual rate of $21,672 paid by a subsidiary; E. M. Herr $76,676 in 1928 and $28,908 in 1932; Walter Cary $58,210 in 1930, $42,645 in 1932 and salary of $6,586 in 1933; James C. Bennett $52,506 in 1930, $13,582 in 1932 and salary of $14,646 in 1933, and H. P. Davis $66,001 in 1930 and bonus of $480 in 1931.

What holding company men received

Standard Gas & Electric Company paid John J. O'Brien $79,810 in 1930, $70,913 in 1932 and salary of $63,750 in 1933 and R. F. Pack $55,060 in 1928 and $55,070 in 1929. Stone & Webster, Inc., in addition to Charles A. Stone, already given, paid E. S. Webster $100,751 in 1930 and $33,610 in 1932 and salary of $28,200 in 1933; H. C. Bradlee $75,609 in 1930 and $26,560 in 1932; E. S. Webster, Jr., $50,793 in 1930 and $7,963 to 3/17/1931; G. H. Clifford $50,300 in 1930 and $35,983 in 1932; H. H. Hunt $50,290 in 1930 and $19,673 in 1932, with salary only of $10,000 in 1933; J. H. Manning $109,-388 in 1930 and $46,063 in 1932 and C. F. Higginson, Jr., $50,951 in 1930 and $35,621 in 1932 and salary of $25,000 in 1933. United Corporation paid G. W. Howard $76,049 in 1931 and salary of $75,000 in 1933. Utilities Power & Light Company paid H. L. Clarke $75,650 in 1930, $61,193 in 1932 and salary of $29,600 in 1933 and F. W. Drury $62,343 in 1929.

Engineers Public Service Company paid Charles W. Kellogg $50,340 in 1930, $41,273 in 1932 and salary of $35,000 in 1933. North American Edison Company paid L. H. Egan $79,550 in 1930, $56,810 in 1932 and $54,000 salary in 1933 and S. B. Way $70,530, $55,750 and $46,500 for the same years respectively. North American Company paid F. L. Dame (deceased) $110,440 in 1930, $85,990 in 1932 and salary of $85,000 in 1933; Edwin Gruhl (deceased) $91,468 and $68,412 in 1930 and 1932; H. C. Freeman $65,140 in 1930, $45,580 in 1932 and salary of $45,000 in 1933; Robert Lindsay $68,000 in 1931 and $66,500 in 1932; C. W. Hough, $37,-650 in 1930 and $23,753 in 1932, with a salary of $22,725 in 1933, and Robert

Sealy $52,870, $40,690 and salary of $40,000 for the same years. Some North American salaries and bonuses include payments from subsidiaries. Philadelphia Company paid F. R. Phillips $67,310 in 1932 and salary of $42,500 in 1933. Public Service Corporation of New Jersey paid T. N. McCarter $100,309 in 1931 and $97,190 in 1932, with a salary alone of $75,000 in 1933; P. S. Young $75,505 in 1930, $58,505 in 1932 and salary of $45,000 in 1933 and W. W. Wakelee $75,530 in 1930, $58,385 in 1932 and salary of $45,000 in 1933.

New York Utility's Assets Increased by Power Merger

Testimony before the Federal Trade Commission at a hearing last week showed that the assets of the New York Power & Light Corporation, one of the Niagara Hudson group, increased from $106,615,968 in October, 1927, to $141,690,927 in December, 1931, due largely to the merger of five companies, two acquisitions of properties, the construction of $24,729,325 of electric plant, construction of $3,947,157 of gas plant and to the capitalization of the benefits of the Sacandaga Reservoir.

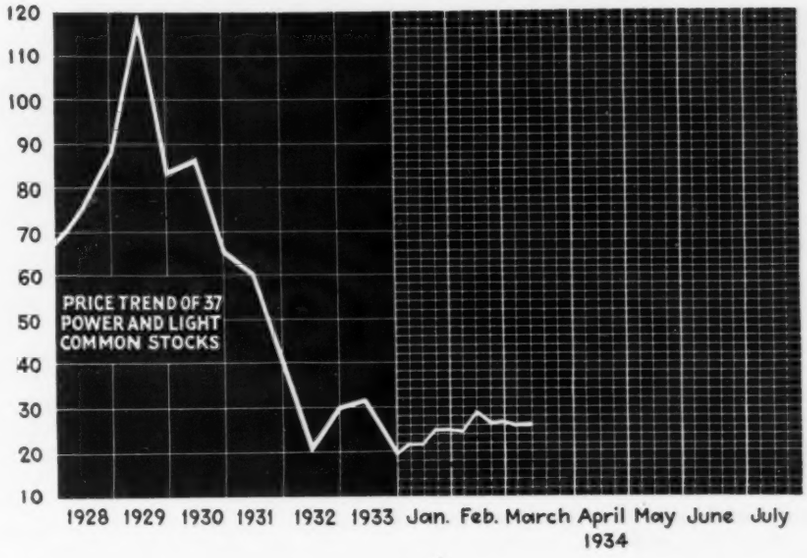
New York Power & Light was incorporated by the consolidation of Adirondack Power & Light Corporation, Municipal Gas Company (Albany), Troy Gas Company, Adirondack Electric Power Corporation, Fulton Gas & Electric Company and Cohoes Power & Light Corporation. Control remained in the Mohawk-Hudson Power Corporation, owning a majority of the voting stock of the constituent companies.

The rate of return on the common stock equity and the dividends paid on the common stock of the corporation are tabulated below:

Year	Per Cent of Dividends per Share to Average Book Value per Share of Com. Stock	Rate of Return on Common Stock Equity
1928	16.11 per cent	25.89 per cent
1929	19.54 per cent	33.03 per cent
1930	22.31 per cent	32.49 per cent
1931	24.13 per cent	23.35 per cent

At the hearing testimony showed that the losses incurred annually by the Adirondack Realty Holding Corporation were assumed by the New York Power & Light.

Utility Stocks Move Narrowly



Activity in virtually all the financial markets slackened this week and prices drifted fractionally in dull trading. "Electrical World" index 25.9; last week 25.6

Federal Utility's Plans

Since the submission of the plan and agreement of reorganization of the Federal Public Service Corporation, Chicago holding company in receivership dated November 15, 1933, the reorganization committee has received the deposit of more than 83 per cent of the first lien bonds, more than 78 per cent of the convertible notes and more than 80 per cent of the preferred stock. The U. S. District Court approved the plan last year (ELECTRICAL WORLD, December 2, page 711).

Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Brooklyn Edison (Year ended December 31)					
Gross earnings	$45,756,400	$47,562,379	— 3.8	67	66
Net earnings	15,160,932	16,243,129	— 6.7		
Net balance	12,131,220	13,326,314	— 8.9		
Consolidated Gas, Electric Light & Power of Baltimore (Year ended December 31)					
Gross earnings	27,465,445	27,506,531	— 0.1	60	60
Net earnings	8,517,329	8,791,324	— 3.1		
Net balance	4,559,649	5,006,687	— 8.9		
Kansas City Power & Light (Year ended December 31)					
Gross earnings	14,202,293	14,767,388	— 3.8	64	61
Net earnings	5,104,636	5,736,179	— 11.0		
Net balance*	3,212,725	3,952,869	— 18.7		
Puget Sound Power & Light (Year ended December 31)					
Gross earnings	12,599,281	13,549,978	— 7.0	65	61
Net earnings	4,408,623	5,319,210	— 17.1		
Net balance	1,295,783†	391,203	—430.0		
Southern California Edison (Year ended December 31)					
Gross earnings	35,251,630	37,158,391	— 5.1	48	44
Net earnings	18,428,807	20,843,428	— 11.6		
Net balance*	11,136,420	13,728,085	— 18.9		
Detroit Edison (Year ended January 31)	1934	1933			
Gross earnings	41,525,543	43,567,767	— 4.7	69	71
Net earnings	13,046,561	12,689,382	2.8		
Net balance	6,358,560	6,347,429	0.2		

Holding Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
American Gas & Electric and subsidiaries (Year ended December 31)					
Gross earnings	$63,362,592	$65,092,459	— 2.6	60	58
Net balance	7,559,511	9,592,965	— 21.2		
Columbia Gas & Electric and subsidiaries (Year ended December 31)					
Gross earnings	74,453,316	79,155,168	— 5.9	70	66
Net balance	5,940,349	11,120,027	— 46.6		
Commonwealth & Southern and subsidiaries (Year ended January 31)	1934	1933			
Gross earnings	109,310,013	113,202,670	— 3.4	55	54
Net balance	512,277†	3,390,436	—115.0		
Public Service of New Jersey and subsidiaries (Year ended January 31)					
Gross earnings	116,926,889	124,292,510	— 5.9	65	66
Net balance	26,706,757	27,478,464	— 2.8		

*Applicable to all dividends. †Deficit.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

General Electric Men Receive Coffin Awards

Citation of 32 General Electric Company employees for their contributions in 1933 to the progress and prestige of the company and to the advancement of the electric art has been made by the Charles A. Coffin Foundation.

Yearly awards have been made since 1922, when the foundation was established by the board of directors of General Electric as a tribute to the founder and first president of the company. Each citation consists of a certificate and a cash award. The awards are divided among ten engineers and other designers, workmen and commercial men. Seven relate to the refrigerator, three to the "Thyratron," three to the incandescent lamp and three joint awards to the men who handled the company's Century of Progress exhibits.

Loyal V. Bewley, engineer in the power transformer department at Pittsfield, Mass., is cited for a revolutionary new mathematical theory which greatly aids engineers in safeguarding transmission lines from lightning; Thomas O. Moffit, a foreman in the Newark lamp works, for devising a process which practically eliminates the unsightly streaks and spots on the globes of automobile lamps, and Frank M. Clark, physicist in the laboratory of the Pittsfield Works, for his development of "Pyranol," a non-inflammable and non-explosive liquid substituted for oil in insulating transformers.

Springfield Wage Area Set in Westinghouse Dispute

Final settlement of the dispute about hourly wage rates at the Springfield and Chicopee Falls, Mass., plants of the Westinghouse Electric & Manufacturing Company has been reported to the National Labor Board. Under the terms of the board's settlement of the strike of 2,700 workers at the two plants on October 20, 1933 (ELECTRICAL WORLD, October 28, 1933, page 549), hourly wage rates were to be negotiated by the parties in accordance with the wage rates "in the industrial area" and the rates agreed upon within six months would be retroactive to October 23, 1933, the day the strike ended. Disagreement arose over the definition of "the industrial area" to be used as the basis for wage scales. The parties in interest have agreed to include Springfield, Holyoke, Chicopee, Chicopee Falls, Ludlow, West Springfield and Westfield as within this area. The matter of rates has been agreeably settled.

New York Metal Prices

	Feb. 27, 1934 Cents per Pound	Mar. 6, 1934 Cents per Pound
Copper, electrolytic	8.00	8.00
Lead, Am. S. & R. price	4.00	4.00
Antimony	7.20	7.35
Nickel ingot	35.00	35.00
Zinc, spot	4.75	4.75
Tin, Straits	52.50	52.50
Aluminum, 99 per cent	23.30	23.30

Governor Bryan Favors Nebraska Hydro Plan

Government kilowatt-hours are dated to flow to market from the Platte Valley project in Nebraska by October, 1936, as a result of Governor Bryan's approval of the combination power and irirgation projects at Sutherland and Columbus. Public ownership advocates in the state, particularly those interested in the various public power projects to be sweetened by appropriations of public funds, had complained of unnecessary delay on the part of the Governor in passing upon their applications for water rights (ELECTRICAL WORLD, February 10, page 237). Government loans and grants total $15,000,000 for the two projects, which will give employment to 4,000 men for about three years.

Among the conditions laid down in the state grant of rights to use water are that no electrical energy shall be sold outside the state until all demands within the state have been supplied, and that there shall be no discrimination in rates for power sold to power companies or municipalities. No money can be paid out of the funds secured for promotional expenses and legal expenses must not include any pay for lobbyists active in getting the government grants.

Maytag Income Jumps

Maytag Company and subsidiaries report for 1933 a net income after depreciation, federal taxes, and other charges, of $1,204,503, equivalent after dividend requirements on $6 first preferred stock to $2.97 a share on 285,488 preference shares, compared with $100,773, or $1.70 a share, on 59,263 shares of $6 first preferred stock in 1932. Net sales for the year were $8,589,053, against $5,143,063 the year previous.

G.E. Plans Sales Tour

Anticipating a prosperous spring season on specialty appliances, the merchandise department of the General Electric Company at Bridgeport will launch a sales campaign on March 19 involving visits to radio, cleaner and home laundry equipment distributors and dealers in 32 key cities. The campaign, termed a "Prosperity Parade," will embrace two tours of three weeks each which will extend over half the United States and will include many meetings with refrigerator and merchandise distributors and their specialty salesmen.

Major New Construction This Week

New York Rapid Transit Corporation, Brooklyn, N. Y., has authorized fund of $178,186 for purchase of new electrical equipment for increased power supply and distribution.

Crown Brewing Company, South Boston, Mass., plans new $1,000,000 plant. A large part of cost to be for equipment purchases.

Motors, controls, regulators, conveyors and other equipment will be installed in new mill of Industrial Rayon Corporation, Cleveland, Ohio, near Fort Wayne, Ind. Cost over $1,000,000.

Coon Rapids, Iowa, asks bids until March 27 for equipment for new city-owned Diesel electric light and power plant and distribution system. Fund of $114,000 available.

Prince George Brewing Company, Laurel, Md., recently organized, plans new $400,000 plant.

State water rights have been secured and plans authorized by Loup River Public Power District, Columbus, Neb., for two hydro-electric generating plants for power and irrigation project, aggregating 58,500 hp., and transmission lines to points near Sioux City, Omaha and Lincoln, Neb. Power substations, switching stations and electric pumping plants will be constructed. A $7,300,000 project.

California Grape Products Company, San Francisco, Calif., plans new winery, with power plant, at Delano, Calif. Cost $140,000.

Heavy-duty motors, controls, regulators, conveyors, etc., will be installed in $150,000 addition to plant of Steel Company of Canada, Ltd., Hamilton, Ont.

Galveston Brewing Company, Galveston, Tex., plans extensions and improvements to cost about $200,000.

Driver-Harris "in the Black"

The Driver-Harris Company, Harrison, N. J., reports for 1933 a net income, after federal taxes, expenses, depreciation and other charges, of $132,581, equal after preferred dividends to 67 cents each on 89,170 common shares. The company had a net loss of $378,671 in 1932.

Cutler-Hammer Cuts Loss

According to its report for 1933, Cutler-Hammer, Inc., had a net loss after depreciation, taxes and other charges of $130,386, compared with $738,110 loss in 1932.

MEN OF THE INDUSTRY

S. H. HULL, New London attorney, has been elected a director of the Connecticut Power Company.

HENRY A. MORSS, treasurer of the Simplex Wire & Cable Company, has been named president and treasurer of that organization.

W. L. BRESLIN, who has been connected with the Savannah (Ga.) Electric & Power Company since 1929, has been elected secretary and treasurer to succeed H. V. Faber.

PAUL J. MYLER, president of the Canadian Westinghouse Company of Hamilton, Ont., has been elected chairman of the company to succeed the late H. H. Westinghouse. Mr. Myler will also retain the presidency of the company.

EDWARD F. BULMAHN, formerly vice-president and general manager of the Iowa Southern Utilities Company, Centerville, Iowa, has been named president of that company. Mr. Bulmahn has been in charge of operations at the Centerville plant for more than fourteen years.

CLAY C. BOSWELL has been appointed chief engineer of the Minnesota Power & Light Company to succeed Leroy M. Pharis. Mr. Pharis resigned his position to become affiliated with the Shanghai Power Company in Shanghai, China. Mr. Boswell was formerly Mr. Pharis' assistant.

W. T. NEILL, formerly assistant general manager of Pacific Power & Light Company, Portland, Ore., has been made manager of the rate department of this company, the Northwestern Electric Company and the Portland Gas & Coke Company, the three subsidiaries of American Power & Light Company in Portland. This is a new department organized to conduct rate studies and prepare statistical material for regulatory bodies in Oregon and Washington.

EVERETT CHAPMAN, who joined Lukenweld, Inc., division of Lukens Steel Company, Coatesville, Pa., early in 1930 as director of engineering and research, has been elected vice-president. Lukenweld, Inc. is engaged in the design and manufacture of welded steel assemblies for machinery and equipment. After graduation in 1924 from the University of Michigan, Mr. Chapman taught electrical engineering at Purdue University, leaving to serve the Lincoln Electric Company of Cleveland, on experimental research and development. Since joining Lukenweld, Inc., Mr. Chapman has been credited with responsibility for that organization's engineering achievements in the application of welded steel construction to Diesel engines, presses, planers, lathes and other machinery and equipment.

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J. H. Ferry Appointed to Potomac Vice-Presidency

James H. Ferry, chief engineer of the Potomac Electric Power Company of Washington, D. C., was appointed vice-president of that organization at the recent meeting of its board of directors. Mr. Ferry, who is well known in electrical engineering circles, was born in Washington. Joining Potomac Electric Power in 1906, he rose through

various positions in the engineering departments of the company, finally becoming chief engineer, a position he still retains with his promotion to the vice-presidency. A former chairman of the Washington section of the American Institute of Electrical Engineers, Mr. Ferry also holds membership in other technical societies.

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E. T. TABER has been appointed merchandise sales director of the Iowa-Nebraska Light & Power Company to succeed C. W. Theleen, resigned.

L. M. CHRISTIE, vice-president of the National Fireproofing Corporation of Pittsburgh, in charge of clay conduit sales, is now directing the sales of all products of the corporation.

JOHN H. AIKEN, assistant to the vice-president of the New York Edison Company, was appointed treasurer, at the organization meeting of the company held recently, to succeed Frederick Smith, who retired after forty years with the company. Mr. Aiken entered the employ of the United Electric Light & Power Company as a statistician in 1922, becoming chief of the statistical department three years later. Subsequently he became an executive assistant in the executive offices. Later he was made an assistant secretary of the United company, which position he continued to hold subsequent to becoming assistant to vice-president Grove last year. BERNARD S. RODEY, assistant auditor of the New York Edison, was appointed auditor and LAURENCE Y. MENEELY, fixed capital engineer, was appointed assistant auditor. Mr. Rodey and Mr. Meneely were appointed to identical positions in the United company at its organization meeting February 6.

OBITUARY

ISHMAEL W. MACY, 35 years old, engineer for the Indiana Public Service Commission, died recently at his home in Indianapolis. A graduate of Purdue University, he had patented several inventions.

FLORANCE J. SCHWAB, manager of the industrial and commercial service department of the New Orleans Public Service, Inc., died February 20. A graduate of Cornell University, Mr. Schwab had been in the employ of the New Orleans Public Service and its predecessor, the New Orleans Railway & Light Company, since 1907.

EDWARD F. WICKWIRE, well known in the electrical light and power and the electric railway industries, and for many years connected with the Ohio Brass Company, Mansfield, died February 24. Entering the employ of the Ohio Brass Company in 1903 as a salesman, he advanced to the positions of sales manager, secretary, vice-president and director of the company. He retired from active business about four years ago.

WALTER W. REED, electrical engineer in the Bureau of Yards and Docks of the Navy Department, Washington, D. C., died recently in that city. A native of Waltham, Mass., and a graduate of the Massachusetts Institute of Technology, Mr. Reed spent several years in and near Boston and New York before going to Houston, Tex., where he became connected with the Houston Light & Power Company for a period of eighteen years as plant superintendent. He was employed as an electrical engineer in the Navy Department from 1918 until the time of his death, with the exception of three years between 1923 and 1926 during which time he was in the employ, first of the Dwight P. Robinson Company and later of the Holland Tunnel Commission.

NEW EQUIPMENT

Photoflood Lamp Life Is Quadrupled

Photoflood lamps of the "Mazda" No. 4 type are now available from the Westinghouse Lamp Company, Bloomfield, N. J., to give four times the illumination of the "Mazda" No. 1 and three to five times the former average life. Consuming 1,000 watts on 105-120 volts, these lamps have a light output of 35,000 lumens, as compared with 9,000 for the No. 1 lamps, and a life of five to ten hours, as compared to an average life of two hours for the smaller size. These lamps are constructed with a PS-35 inside-frosted bulb and have the same efficiency (35 lumens per watt) as the No. 1 and therefore operate at the same color temperature as the smaller size so the same color filters can be used for both. They are designed to be more suitable than the No. 1 style for studio work and are similar in field of application to the lamps recently offered by other manufacturers.

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MULTI-CONTACT RECEPTACLES of metal-clad, heavy-duty construction are announced by the Delta-Star Electric Company, Chicago, for use in connection with metal-clad switchgear and control equipment. They can be bolted flat against an opening in metal housings inclosing the control wiring, thus giving a direct connection with minimum space requirements. Receptacles are made for 3, 4, 5, 6 or 7 poles and all except the three-pole are polarized.

COMPACT INTEGRATING HOUR COUNTERS, identified as Model 691, have been introduced by the Weston Electrical Instrument Corporation, Newark, for measuring elapsed time of operation of electrical equipment. These units consist of a ball-bearing starting synchronous motor, drawing less than 2 watts, connected through high-grade gears to an indicating train on instrument face. The dial type train runs to 9,999 hours and repeats. Panel type bakelite case with flange diameter of 3½ in. and body diameter of 2¾ in. is standard, but a cast aluminum housing can be supplied for surface type mounting. Counter weighs 1 lb. 2 oz., is 4½ in. deep over all and is rated regularly for 110-volt, 60-cycle circuits, but can be furnished for 11 volts for connection in parallel with power tube filaments. This device is meant for measuring running time of electrical machines or for indicating total operating time of devices having units with a definite life, such as vacuum tubes, so that such units can be replaced at the recommended time and obviate failure.

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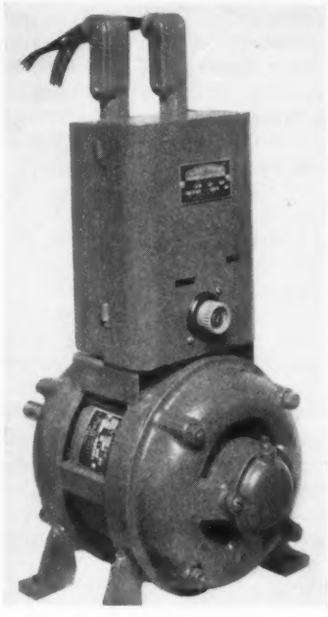
Protected Induction Motors

Self-protected induction motors which cannot burn out are announced by the Lincoln Electric Company, Cleveland, Ohio. Should the motor be stalled through overloading, become excessively



hot due to poor ventilation, run on single phase, or if for any reason the motor is blocked the protector built into the windings shuts off the current and the motor is saved from damage. With self-protection, less supervision of motors is necessary, repair bills are cut and frequently smaller size motors can be used, according to the manufacturer. Where large motors are necessary to take care of only infrequent peak loads a small size self-protected motor may be employed. At the high peak loads the protector will automatically disconnect the motors. These new Lincoln motors are built in sizes from ½ to 30 hp., for either two or three phase and standard commercial cycles and voltages. Controls are mounted on the motors.

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ELECTRIC RANGE SWITCHES of two types are announced by the merchandise department of the General Electric Company, Bridgeport, Conn. These are designed to give the longest possible life without periodic service and to permit replacement of parts with a minimum of expense, labor and delay. One is for the control of surface units of a range and the other for use with single-switch, two-heating-element range ovens. The former is arranged for four-wire d.c. or a.c. systems; the latter is a two-wire switch. Heavy stationary contacts and shaft bearings are molded directly in the phenolic compound base, giving firm contacts and switch bearing that stays in alignment. Operating mechanism is inclosed with the rotor, which is also of high temperature-resisting phenolic compound, so that the protection against dust and dirt adds materially to the mechanical life of the switches. The long, flexible blades are assembled in slots in the rotor, permitting the blades to centralize themselves between the stationary contacts of the base. These switches give long service without the periodic service and lubrication of older range switches.

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Light for Photo-Control

For applications requiring transmission of light beams over a considerable distance, or where the beam must penetrate steam, dust, etc., with sufficient intensity to operate light sensitive controls, the Westinghouse Electric & Manufacturing Company has announced the type E "Light Source." This source has an intensity of 24 foot-candles at 25 ft. It consists of an industrial light-source lamp rated at 6 volts, 5 amp. and 3,000 hours life and a lens for condensing the light rays into a nearly parallel beam. An infra-red filter for an invisible light beam is optional. The steel cabinet housing is suitable for either indoor or outdoor mounting.

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ELECTRIC RANGE RECEPTACLES of attractive modernistic design, arranged electrically for safety and easy wiring, are announced by the Bull Dog Electric Products Company of Detroit. In keeping with modern electric kitchens, these decorative receptacles have bakelite covers in black or colors to match color schemes. They are approved for 50-amp., 250-volt service.

ALL-PORCELAIN VITREOUS ENAMELED RHEOSTATS, Ohmite Model K, for the control of small motors, generators or electronic devices, have been introduced by the Ohmite Manufacturing Company, Chicago. This 100-watt model is a new size and differs in construction from former models in that it has an insulated shaft and bushing and the stops at the ends of the winding are incorporated with the shaft and bushing mechanism. Thus, there cannot be any strain on the arm except that needed to move the contact shoe over the winding. The unit is 3 in. in diameter and 1½ in. deep behind the panel.